

-PHOTOGRAPHIC- WORKROOM HANDBOOK

BY SIGISMUND BLUMANN

PRICE \$1.00



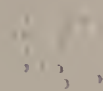
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~PHOTOGRAPHIC~ WORKROOM HANDBOOK

BY SIGISMUND BLUMANN

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PREFACE

WITH so many fine books on the market—such big, complete books—one might consider the present modest volume redundant and presumptuous. I have had moments of doubt when the purpose was lost in the seeming inadequacy, and the persistent kindness of my friends in speaking of Blumann's book made me doubly timid. But the fact is brought home to us, in these offices in which CAMERA CRAFT is conceived and consummated, that just this kind of a book is wanted. The first purpose has been kept in view, to make it handy and authoritative; the first intention conserved to permit nothing between its covers but what is of every day use.

You shall find only two or three recipes under any heading and these the simplest, best, and most easily compounded. In no case are they mere reprints taken on trust, but have been tried again and again under test conditions and in the way in which the reader should be likely to use them.

Nor is all the matter submitted just compilation, since some original research, and much data collected from original sources has been gathered to serve the object of the handbook.

Let me, also, at this time, pay the reader the compliment of stating that in deference to his good sense and understanding all long and unnecessarily minute directions have been omitted. If the text be not foolproof it is because it has not been issued to fools. It is presumed that purchasers of a handbook of this sort know that chemicals are to be dissolved in the order given and that the next chemical is not to be added to a solution until the last has dissolved; that it is safe to consider every photographic chemical as poisonous. They are not all dangerous but none is good to eat or drink.

When you want to develop your negatives turn to the proper page and readily find the formula you know suits your needs. There will be no mass of other formulae through which to wade. When you want to tone a print you will find that recipe with ease and will, moreover, find it does what it is intended to do. Follow the operations as printed and be done with the job.

There is no literature herein. The chapters on Retouching, Portrait Lighting, Bromoil, and so forth are limited to real, unelaborated information. If, through the inadvisability of attempting to teach what cannot be taught within the scope of this book the directions be meager, then the best sources of information have been recommended.

I have a very definite purpose, to repeat, in giving you this little work. May it be granted to have given you what suits your purpose.

My readers have always been my friends and so this preface shall be my dedication to them.

SIGISMUND BLUMANN, A. S. P. S.

San Francisco, California

December 1926

PHOTOGRAPHIC WORKROOM HANDBOOK

BY SIGISMUND BLUMANN

MIXING SOLUTIONS

Dissolve part of the Sulphite in the water, then the Developing agents, then the rest of the Sulphite, then the carbonate.

Let the water be warm enough to produce prompt dissolving but **no warmer** than necessary.

CONCENTRATED SOLUTION

Never concentrate beyond 3 to 4 times normal or crystallization will result.

HYPO

May be melted in hot water but the bisulphites or acids should not be added till cool or sulphur precipitation results.

PERCENTAGE SOLUTIONS, To Mix

Dissolve chemical in part of the amount of water specified and make up to full measure, viz.: 5% solution Hypo.

Dissolve 5 ounces Hypo in say 10 ounces of water and add water to make up to 100 ounces.

Percentage solutions are taken to mean that part of the whole bulk which a given ingredient constitutes.

EQUIVALENTS

100 parts Caustic Soda equals 133 parts Caustic Potash
100 parts Caustic Soda equals 167 parts Carbonate Potash
100 parts Caustic Soda equals 176 parts Carbonate Sodium
Sodium Bisulphite and Potassium Bisulphite Equale
Sodium Bromide and Potassium Bromide equal
Alum Potassium 3 parts, or Alum Sulphate 2 parts
Citric and Tarturic Acids equal

LABELS

Write your bottle labels with Water-proof India Ink. Paste them on and let them be thoroughly dry, then brush over them the thick Celluloid Solution given under head of Celluloid Negative Varnish. When set hard repeat. Two or three coats will make your labels virtually water and chemical proof.

DEVELOPMENT POINTERS

Soft development tends to softness.
Long development tends to contrast.
Alkali increases contrast.
Bromide increases contrast.
Concentration increases contrast.
Dilution gives softness.
Strong Pyro, Hydroquinon at 65° F or over give contrast.
Metol, Glycin, dilute Pyro give softness.
The above, where applicable, applies to Bromide Papers, always remembering that proper exposure is a governing factor.
Hard negative, soft print; long exposure, short development.
Soft negative, contrasty print; short exposure, long development.
Remember in each instance that carbonate increases contrast, that Bromide not only increases contrast but averts fog.
Metol gives soft effects and bluish blacks.
Hydroquinon, harsh effects and greenish blacks.
The following summary will apply, generally speaking, to Plates, Films, Bromide and Gaslight Papers.

DEVELOPING FORMULA CHART

	"M. Q." dev. for P. M. C. bromide	"M. Q." for EK Portrait bromide	"M. Q." for Regular CYKO	Amidol for Wellington bromide	
Water.....	8 oz.	8 oz.	8 oz.	8 oz.	.....
Metol.....	3 grs.	6 grs.	3 grs.		.....
Sodium Sulphite (dry) ..	40 grs.	90 grs.	85 grs.	130 grs.	.....
Amidol.....				20 grs.	.....
Hydrochinone.....	12 grs.	22 grs.	12 grs.		.....
Sodium Carbonate (dry)	55 grs.	90 grs.	65 grs.		.....
Potassium Bromide.....	1½ grs.	3 grs.	1 gr.	4 grs.	.....

AMIDOL, Acid—Keeps Well for Few Days—Bromide Papers

Water..... 40 ounces
Sodium Sulphite..... 6 ounces
Citric Acid..... 120 gr.
Sulphite Iron..... 1 ounce
Potassium Bromide..... 4 drams

Use: Water 10 ounces, Stock 2½ ounces, Amidol 30 gr.
While this keeps—a fresh solution is better.

AMIDOL (Diamido Phenol Hydrochloride)—Bromide Papers EASTMAN BROMIDE

Water.....	6 $\frac{1}{4}$ ounces
Sodium Sulphite.....	$\frac{3}{4}$ ounces
Amidol.....	$\frac{1}{4}$ ounces

Use: One ounce to four water. Bromide Potassium Q. S.

AMIDOL—Plates or Films

Dissolve 3 ounces (anhydrous) Sulphite Sodium in 16 ounces hot water, add 3 drachms Potassium Metabisulphite and boil in the solution and bottle.

To 16 ounces of water add 3 ounces of the above stock solution and in this dissolve 35 grains of Amidol.

This will be found an excellent developer for plates, films, papers, and lantern slides. The Amidol content may be lessened or increased by four or five grains for special effects.

GLYCIN, Tank—25 Minutes—65°—Plates or Films

Hot Water.....	60 ounces
Sodium Carbonate.....	2 ounces
Glycin.....	$\frac{1}{2}$ ounce
Sodium Sulfite.....	$\frac{1}{2}$ ounce

Use: Stock 6 ounces. Water 58 ounces.

GLYCIN (Hübl)—Plates, Films, Papers

Make a thick cream or paste which dilute as needed. The effervescence and discharge of gas need not alarm you.

Boiling water.....	4 ounces
Sulphite Sodium (anhydrous).....	10 drachms

When thoroughly dissolved stir in slowly till a homogeneous paste or semi-solution is achieved.

Glycin.....	4 drachms
-------------	-----------

After which stir in very gradually.

Potassium Carbonate (anhydrous).....	20 drachms
--------------------------------------	------------

To use take 1 ounce of this paste to 10 ounces of water. For softer results dilute till desired effect is gained.

GLYCIN-HYDROXIDE (Blumann)—Plates, Films, Papers

We developed a formula which has excited so much contradictory opinion and so much positive praise and condemnation that we put it here for what it may do in emergencies. We have used plates, films and papers which were so fogged by age as to be worthless and have gotten workable negatives and prints with this developer. It regains life after being apparently used up by adding a little of the hydroxide solution, and it works clear and clean after it has oxidized to a treacly thickness and color. Use it with judgment in time of need or leave it alone.

Water, boiling hot.....	32 ounces
Sodium Sulphite (anhydrous).....	75 grains
Sodium or Potassium Hydroxide (C. P.).....	240 grains
Glycin.....	60 grains

Use full strength for strong contrast to fit for underexposure and remember it will stand up to five times its bulk of dilution. For overexposure add a ten percent solution of Bromide in five-drop doses till needed result is obtained. It will take an enormous amount of Bromide without fogging or degrading the tone.

Just before using add a drop or two of Formaldehyde to the ounce to prevent disintegrating the emulsion.

This has given the writer usable negatives from plates ten times over and five times under exposure. It works equally on plates, papers or films.

Keep the temperature below 65° F.

DEVELOPER—Extreme Contrast—Plates or Films

A Water.....	20 ounces
Hydroquinon.....	1 ounce
Bisulph Soda.....	1 ounce
Bromide Potassium.....	1 ounce
B Water.....	20 ounces
Potassium Hydroxide.....	2 ounces

Use "A" 1 ounce, "B" 1 ounce. Water 1 ounce.

The more water the less contrast.

For Process, Transparency and Lantern Plates dilute with 3 or 4 ounces water.

UNIVERSAL PRINT DEVELOPER

Metol.....	10 grains
Hydroquinon.....	40 grains
Sodium Sulphite (crystal).....	1 ounce or
(anhyd).....	½ ounce
Sodium Carbonate (crystal).....	1½ ounce or
(anhyd).....	¾ oz. or less
Potassium Bromide.....	10 grains
Water.....	20 ounces

The above are given by the Professional Photographers' Association Record of Great Britain as the best "all 'round" developers. In testing they used the leading British and American Plates, Films, and Papers. The developers evolved were found to average best, not only on all negatives and positive emulsions, but on emulsions of all speed ratings, as well as on bromide and chloride papers.

My own experience has been that the Bromide will need adjusting.

UNIVERSAL PAPER—Bromides or Chlorides

From "American Photography." Tried under every condition by the writer and found perfect.

A	Metol.....	$\frac{1}{4}$ ounce	72 grains
	Sodium Sulphite.....	6 ounces	53 grains
	Hydroquinon.....	$1\frac{1}{2}$ ounces	57 grains
	Water to.....	100 ounces	
B	Sodium Carbonate.....		1 ounce
	Water.....		9 ounces
C	Potassium Bromide.....		$\frac{1}{2}$ ounce
	Water.....		$4\frac{1}{2}$ ounces

Use: To 10 ounces water add:

	A	B	C
Velox.....	2 ounces	$12\frac{1}{2}$ drams	20 min.
Azo.....	2 ounces	$12\frac{1}{2}$ drams	15 min.
Iris.....	2 ounces	$6\frac{1}{4}$ drams	36 min.
Prof. Cyko.....	2 ounces	9 drams	8 to 10 min.
Haloid.....	2 ounces	9 drams	30 min.
Prof. Defender.....	2 ounces	9 drams	45 min.
Etching Brown.....	2 ounces	$4\frac{1}{4}$ drams	54 min.
Old Master.....	2 ounces	$6\frac{1}{4}$ drams	27 min.
Haloid Press.....	3 ounces	2 oz. 6 drams	25 min.
Prof. Defender Warm.	1 oz. 5dr.	3 drams	1 to 4 dr.
Iris for soft effects....	$6\frac{1}{4}$ ounces	3 drams	33 min.

and add water to make 10 ounces and Metol 3 to 5 gr.

(For Bromides use any of above diluted 2 to 3 times).

UNIVERSAL NEGATIVE DEVELOPER

Metol.....	10 grains
Hydroquinon.....	40 grains
Pyro.....	10 grains
Sodium Sulphite (crystal).....	$1\frac{1}{2}$ ounces or
(dry).....	$\frac{3}{4}$ ounce
Sodium Carbonate (crystal).....	1 ounce or
(dry).....	$\frac{1}{2}$ oz. or less
Potassium Bromide.....	5 grains
Water.....	20 ounces

METOL—Soft Effects—Bromide Papers

Water.....	25 ounces
Metol.....	25 grains
Sodium Sulphite.....	100 grains
Sodium Carbonate.....	140 grains
Potassium Bromide.....	40 grains

For stale paper souse with Bromide 10% solution.

DEVELOPER—M. Q. Concentrated—Plates, Films and Papers

Metol.....	90 grains
Hydroquinon.....	350 grains
Water (distilled).....	14½ ounces

Heat the water to 112 deg. F. and dissolve the Metol and Hydroquinon therein, then add 1200 grains Sodium Sulphite (anhydrous). Stir for two or three minutes. A gray-white precipitate will form. Now add pure stick Sodium Hydroxide, 220 grains, and stir until it has dissolved and the precipitate with it. Filter quickly through loose absorbent cotton and bottle.

To use, take:

Stock Solution.....	1 part
Water.....	15 parts
Potassium Bromide.....	As needed
Formaldehyde.....	1 drop to each ounce

For tank:

Stock Solution.....	1 part
Water.....	3 parts

DEVELOPER—Great Contrast—Bromide and Gaslight Papers

Water.....	1000 c.c.	35 ounces
Metol.....	0.5 gram	7½ grains
Sodium Sulphite (Anhydrous)....	50 grams	1¾ ounces
Hydroquinon.....	5 grams	75 grains
Sodium Carbonate (Crystals)....	100 grams	3½ ounces
Potassium Bromide.....	2 grams	15 grains

Keeps well and gives prints from negatives that are quite impossible otherwise.

NEPERA SOLUTION—Bromides or Chlorides

Hot Water.....	100 ounces
Metol.....	½ ounce
Hydroquinon.....	2 ounces
Sodium Sulphite.....	7½ ounces
Sodium Carbonate.....	12½ ounces
Potassium Bromide.....	120 ounces

Dilute according to brand of paper used or effect desired from 2 to 8. One of the best Gaslight Paper developers we know.

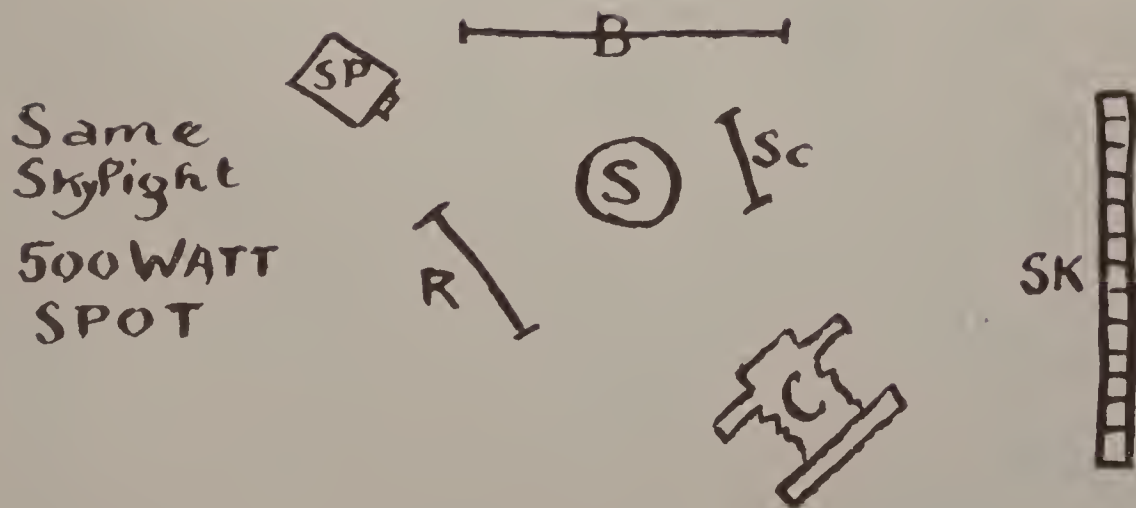
PYRO DEVELOPER FOR PAPER

Water.....	20 ounces
Potassium Metabisulphite.....	20 grains
Sodium Sulphite.....	1 ounce
Pyro.....	60 grains
Sodium Carbonate.....	1 ounce
Potassium Bromide.....	60 grains

The B. J. Non-Staining Pyro Developer for plates works equally well on Bromide Papers.



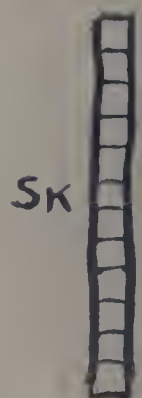
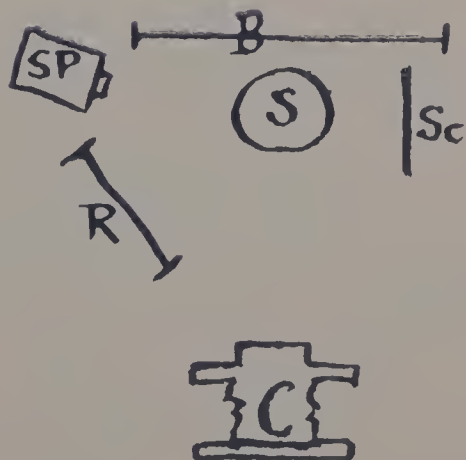
PORTRAIT BY J. ANTHONY BILL





PORTRAIT BY J. ANTHONY BILL

Single
 Spant
 12 x 20
 20°
 SKYLIGHT
 SUBJECT
 12 Feet
 from Light



PYRO-SODA—Plates and Films**The Famous B. J. Non-Staining Formula**

A	Water.....	15 ounces
	Pyro.....	120 grains
	Sodium Sulphite (anhydrous).....	1 ounce
	Potassium Metabisulphite.....	120 grains
B	Water.....	15 ounces
	Sodium Carbonate (anhydrous).....	1 ounce 1 drachm

When ready to use take 1 part of each and add 2 parts of water.

In making up the "A" solution mix the sulphite and the metabisulphite together dry, add to the water and boil the solution.

For very strong negatives use 1 part of each and no water, or equal parts of "A," "B," and water.

Bromide only if needed and in the least quantity that will clear up the shadows.

PYRO, Good Quality and Fast for Negatives—Plates and Films

A	Water.....	1 gallon
	Potassium Meta-Bisulphite	200 grains
	Pyro.....	4 ounces
	Bromide.....	½ ounce
B	Water.....	1 gallon
	Sodium Sulphite.....	4 ounces
	Sodium Carbonate.....	4 ounces

Use "A" 4 ounces, "B" 4 ounces, Water 8 ounces.

For fast exposures omit the water and use stock full strength.

DEEP TANK DEVELOPER FORMULA (D-18) FOR KODAK AUTOGRAPHIC AND N-C FILM

To Make	1 Gal.	30 Gals.	14 Gals.	18 Gals.	48 Gals.
Water.....	½ gal.	1 gal.	2 gals.	2½ gals.	5 gals.
Elon.....	10 grs.	100 grs.	140 grs.	180 grs.	1¼ ozs.
Sodium Sulphite.....	1¼ ozs.	12½ ozs.	17½ ozs.	22½ ozs.	60 ozs.
Sodium Bisulphite.....	15 grs.	150 grs.	½ oz.	270 grs.	1¾ ozs.
Hydrochinon.....	40 grs.	1 oz.	1¼ ozs.	1¾ ozs.	4½ ozs.
Sodium Carb.	300 grs.	6¾ ozs.	9½ ozs.	12¼ ozs.	32½ ozs.
Pyro.....	100 grs.	2¼ ozs.	3¼ ozs.	4 ozs.	11 ozs.
Potassium Bromide.....	6 grs.	60 grs.	85 grs.	110 grs.	290 grs.
Water to make.....	1 gal.	10 gals.	14 gals.	18 gals.	48 gals.

Develop about 15 minutes when new at a temperature of 65° Fahrenheit.

NOTE—Film Pack film must be developed 33⅓% longer than roll film. Time of development should be increased about one minute per day. Keep to volume with same strength developer and discard when any perceptible stain shows between the exposures. Remove scum from surface and stir developer daily before using.

DEVELOPER FORMULA FOR EASTMAN PORTRAIT— Bromide Stock Solution (D-49)

To Make	32 ounces	64 ounces	1 gallon
	Avoirdupois	Metric	
Hot Water (about 125°F.).	16 ounces	500 c.c.	32 ounces 64 ounces
Elon.....	45 grains	3 grams	90 grains 180 grains
Sodium Sulphite	1½ ounces	45 grams	3 ounces 6 ounces
Hydrochinon.....	165 grains	11 grams	¾ ounce 1½ ozs.
Sodium Carb.	1½ ounces	45 grams	3 ounces 6 ounces
Potassium Bromide.....	30 grains	2 grams	60 grains 120 grains
Water to make.....	32 ounces	1 liter	64 ounces 1 gallon

For use, take Stock Solution, 1 part—Water, 1 part.

Develop not less than 1½ minutes at 70 F. (21 C.).

PYRO-METOL—For Negatives and Bromides

A Pyro.....	80 grs. (9.2 gms.)
Metol.....	70 grs. (8 gms.)
Potassium Metabisulphite.....	180 grs. (20 gms.)
Potassium Bromide.....	30 grs. (3.5 gms.)
Water to.....	20 ozs. (1,000 c.c.s.)
B Soda Carbonate Crystals.....	3 ozs. (150 gms.)
Water to.....	20 ozs. (1,000 c.c.s.)

For normal exposures, use equal parts. For under-exposures, increase the proportion of B and add water.

Pyro-metol is a developer which gives both detail and density quickly. The negatives are of slightly greenish-black color, of good printing quality.

DEVELOPER FOR BLUE BLACK TONES ON AZO PAPER FOR PHOTO FINISHING AND COMMERCIAL PURPOSES D-73

To make Stock Solution	32 ozs.	1 liter	1 gal.	5 gals.
	Avoirdupois	Metric		
Water (about 125°F.) (52°C.)..	16 ozs.	500 c.c.	64 ozs.	2½ gals.
Elon.....	40 grns.	2.7 grms.	160 grns.	1¾ ozs.
Sodium Sulphite (E.K.Co.)....	1 oz. }	40 grms.	5¼ ozs.	1 lb. 10 ozs.
	140 grns. }			
Hydrochinon.....	155 grns.	10.6 grms.	1 oz. }	
			185 grns. }	7 ozs.
Sodium Carbonate (E.K.Co.)...	2½ ozs.	75 grms.	10 ozs.	3 lbs. 2 ozs.
Potassium Bromide.....	12 grns.	0.8 grms.	48 grns.	240 grns.
Water to make.....	32 ozs.	1 liter	1 gal.	5 gals.

For use, take Stock Solution 1 part, Water 2 parts.

Develop for 45 seconds at 70°F. (21°C.).

DEVELOPER

For producing three degrees of contrast suitable for VITAVA ATHENA,
Grades A, B, C, D, E and T

D. 64

To make Stock Solution No. 1	32 ozs.	1 liter	64 ozs.	1 gal.
	Avoirdupois	Metric		
Water (about 125°F.) (52°C.)...	16 ozs.	500 c.c.	32 ozs.	64 ozs.
Elon.....	135 grns.	9 grms.	270 grns.	1 ¼ ozs.
Sodium Sulphite (E.K.Co.)....	2 ¼ ozs.	65 grms.	4 ½ ozs.	9 ozs.
Hydrochinon.....	150 grns.	10 grms.	¾ oz.	1 ½ ozs.
Sodium Carbonate (E.K.Co.)...	1 ¾ ozs.	50 grms.	3 ½ ozs.	7 ozs.
Potassium Bromide.....	70 grns.	4.5 grms.	140 grns.	280 grns.
Wood Alcohol.....	3 ozs.	90 c.c.	6 ozs.	12 ozs.
Water to make.....	32 ozs.	1 liter	64 ozs.	128 ozs.

Stock Solution No. 2

Water (about 125°F.) (52°C.)...	16 ozs.	500 c.c.	32 ozs.	64 ozs.
Sodium Sulphite (E.K.Co.)....	2 ¼ ozs.	65 grms.	4 ½ ozs.	9 ozs.
Hydrochinon.....	1 ¼ ozs.	35 grms.	2 ½ ozs.	5 ozs.
Sodium Carbonate (E.K.Co.) ..	1 ¾ ozs.	50 grms.	3 ½ ozs.	7 ozs.
Potassium Bromide.....	70 grns.	4.5 grms.	140 grns.	280 grns.
Wood Alcohol.....	3 ozs.	90 c.c.	6 ozs.	12 ozs.
Water to make.....	32 ozs.	1 liter	64 ozs.	128 ozs.

For use, dilute as follows:

A—Soft (for prints from contrast negatives):

Stock Solution No. 1.....	6 ounces	(180 c.c.)
Water.....	26 ounces	(800 c.c.)

B—Medium (for prints from average negatives):

Stock Solution No. 1.....	3 ounces	(90 c.c.)
Stock Solution No. 2.....	3 ounces	(90 c.c.)
Water.....	26 ounces	(800 c.c.)

C—Hard (for prints from soft or flat negatives):

Stock Solution No. 1.....	3 ounces	(90 c.c.)
Stock Solution No. 2.....	6 ounces	(180 c.c.)
Water.....	23 ounces	(700 c.c.)

To each 32 ounces (1 liter) of developer ready to use, add 1 dram (3.5 c.c.) of 10% Potassium Bromide solution. Temperature of developer—70° Fahrenheit (21° C.).

Just as this book was to go to press the newer Eastman formulas were issued from Rochester. That these might be tried in my own laboratory, the book was held up a few weeks. Needless to say, the recipes are right, and will work on most other papers of the same classes.

DEVELOPER

For VITAVA ATHENA, Grades A, B, C, D, E, and T.; VITAVA ALBA, VITAVA RAPID BLACK and VITAVA ZELTA

	D-52			
To Make Stock Solution	32 ozs.	1 liter	1 gal.	5 gals.
	Avoirdupois	Metric		
Water (about 125°F.) (52°C.) . . .	16 ozs.	500 c.c.	64 ozs.	2½ gals.
Elon	22 grns.	1.5 grms.	88 grns.	1 oz.
Sodium Sulphite (E.K.Co.)	¾ oz.	22.5grms.	3 ozs.	15 ozs.
Hydrochinon	90 grns.	6.2 grms.	360 grns.	4 ozs.
Sodium Carbonate (E.K.Co.) . . .	½ oz.	15 grms.	2 ozs.	10 ozs.
Water to make	32 ozs.	1 liter	1 gal.	5 gals.

For use, dilute as follows:

VITAVA ATHENA—Grades A, B, C, D, E, T: Stock solution 1 part, water 1 part. To each 32 ounces (1 liter) of this developer add ¼ ounce (7.5 c.c.) of 10% Potassium Bromide solution.

VITAVA ALBA—Full strength stock solution. To each 32 ounces (1 liter) of developer add 1 dram (3.5 c.c.) of 10% Potassium Bromide solution.

VITAVA RAPID BLACK—Full strength stock solution. To each 32 ounces (1 liter) of developer add ½ ounce (15 c.c.) of 10% Potassium Bromide solution.

VITAVA ZELTA—Stock solution 1 part, water 1 part. To each 32 ounces (1 liter) of this developer add ½ ounce (15 c.c.) of 10% Potassium Bromide solution.

Develop not less than 1½ minutes at 70°F. (21° C.).

DEVELOPER
For VITAVA RAPID BLACK

	D-52b			
To Make Stock Solution	32 ozs.	1 liter	1 gal.	5 gals.
	Avoirdupois	Metric		
Water (about 125°F. (52°C.) . . .	16 ozs.	500 c.c.	64 ozs.	2½ gals.
Elon	44 grns.	3 grms.	180 grns.	2 ozs.
Sodium Sulphite (E.K.Co.)	1½ ozs.	45 grms.	6 ozs. 1 lb.	14 ozs.
Hydrochinon	180 grns.	12.5grms.	1 oz. {	
			280 grns. }	8¼ ozs.
Sodium Carbonate (E.K.Co.) . . .	1 oz.	30 grms.	4 ozs. 1 lb.	4 ozs.
Potassium Bromide	44 grns.	3 grms.	180 grns.	2 ozs.
Water to make	32 ozs.	1 liter	1 gal.	5 gals.

For use, take Stock Solution 1 part, Water 1 part.

Develop not less than 1½ minutes at 70°F. (21°C.).

Vitava papers should have rather full exposures and adequate development. The vigor of the image is inherent to the paper and needs no stimulus.

DEVELOPER

For VITAVA ETCHING BROWN, ATHENA OLD MASTER, ATHENA LINEN FINISH and ATHENA GRADE F.

	D-65-a			
To Make Stock Solution	32 ozs.	1 liter	1 gal.	5 gals.
	Avoirdupois	Metric		
Water (about 125°F.) (52°C.)...	24 ozs.	750 c.c.	96 ozs.	3¾ gals.
Elon.....	100 grns.	6.9 grms.	400 grns.	4½ ozs.
Sodium Sulphite (E.K.Co.)....	3¼ ozs.	98 grms.	13 ozs.	4 lbs.
Hydrochinon.....	¾ oz.	22.5 grms.	3 ozs.	15 ozs.
Sodium Carbonate (E.K.Co.)...	2¼ ozs.	67.5 grms.	9 ozs. 2 lbs.	13 ozs.
Potassium Bromide.....	50 grns.	3.4 grms.	200 grns. 2oz.	130grns
Wood Alcohol.....	4½ ozs.	140 c.c.	18 ozs.	90 ozs.
Water to make.....	32 ozs.	1 liter	1 gal.	5 gals.

For use, dilute as follows: Stock Solution 1 part; Water 7 parts.

VITAVA ETCHING BROWN—To each 32 ounces (1 liter) of this developer add two drams (7.5 c.c.) of 10% Potassium Bromide solution. For warmer tones, to each 32 ounces (1 liter) of this developer add ½ to ¾ dram (2 to 3 c.c.) of 10% Hydrochloric acid solution, made by diluting 1 part c. p. Hydrochloric acid (Sp. Gr. 1.2) with 9 parts of water.

VITAVA ATHENA OLD MASTER, LINEN FINISH and Grade F—To each 32 ounces (1 liter) of this developer add 1 dram (3.5 c.c.) of 10% Potassium Bromide solution. If colder tones are required with the Grade F paper slightly increase the quantity of Sodium Carbonate.

Develop not less than 1½ minutes at 70°F. (21°C.).

DEVELOPER

FOR PORTRAIT PRINTS ON AZO PAPER

	D-41			
To make Stock Solution	32 ozs.	1 liter	64 ozs.	1 gal.
	Avoirdupois	Metric		
Water (about 125°F.) (52°C.)...	24 ozs.	750 c.c.	48 ozs.	100 ozs.
Elon.....	100 grns.	6.8 grms.	200 grns.	400 grns.
Sodium Sulphite (E.K.Co.)....	3¼ ozs.	97 grms.	6½ ozs.	13 ozs.
Hydrochinon.....	¾ oz.	22.5 grms.	1½ ozs.	3 ozs.
Sodium Carbonate (E.K.Co.)...	2½ ozs.	75 grms.	5 ozs.	10 ozs.
Potassium Bromide.....	55 grns.	3.8 grms.	¼ oz.	½ oz.
Water to make.....	32 ozs.	1 liter	64 ozs.	1 gal.
Wood Alcohol.....	4½ ozs.	140 c.c.	9 ozs.	18 ozs.

For use, take Stock Solution 1 part, Water 7 parts.

Develop about 1½ minutes at 70°F. (21°C.).

Note—Rough surface grades in the Argo, Noko brands should be accepted as rather softer than the others.

DEVELOPER

FOR VELOX, AZO, EASTMAN AND P. M. C. BROMIDE PAPERS
D-72

To make Stock Solution	32 ozs.	1 liter	1 gal.	5 gals.
	Avoirdupois	Metric		
Water (about 125°F.) (52°C.)..	16 ozs.	500 c.c.	64 ozs.	2½ gals.
Elon.....	45 grns.	3 grms.	180 grns.	2 ozs.
Sodium Sulphite (E.K.Co.).....	1½ ozs.	45 grms.	6 ozs. 1 lb.	14 ozs.
Hydrochinon.....	175 grns.	12 grms.	1 oz. }	
			260 grns. }	8 ozs.
Sodium Carbonate (E.K.Co.)...	2¼ ozs.	65 grms.	9 ozs. 2 lbs.	13 ozs.
Potassium Bromide.....	27 grns.	1.8 grms.	¼ oz.	1¼ ozs.
Water to make.....	32 ozs.	1 liter	1 gal.	5 gals.

For use, dilute as follows:	Velox	Azo	Bromide
Stock Solution.....	1 part	1 part	1 part
Water.....	1 part	2 parts	4 parts

Develop Velox and Azo 45 seconds at 70° F. (21°C.).
For colder tones on Azo, dilute as for Velox.
For still colder tones on Azo, use Formula D-73. See page 10.
For Portrait work on Azo, use Formula D-41. See page 13.
Develop Bromide not less than 1½ minutes at 70°F. (21°C.).
For Portrait Bromide, use Formula D-49. See page 10.

PYRO, Tank—20 Minutes—65°—Plates or Films

2½ and 3½-inch Tank—Pyro.....	22 grains
Sodium Sulphite.....	44 grains
Sodium Carbonate ...	44 grains

Fill with water to embossed line on tank.

5 and 7-inch Tank—	Pyro.....	30 grains
	Sodium Sulphite.....	60 grains
	Sodium Carbonate....	60 grains

For ten-minute developer double all ingredients to same quantity of water.
Deduct 1 minute for each degree of temperature above 65°. Add 1 minute for every degree below.

PYRO, Tank—30 Minutes—65°—Plates or Films

A	Water.....	16 ounces
	Pyro.....	1 ounce
	Oxalic.....	10 grains
B	Water.....	16 ounces
	Sulphite.....	3 ounces
C	Water.....	16 ounces
	Carbonate.....	1 ounce

Use: A, B, C, each 1 ounce. Water 61 ounces.
To increase density increase carbonate.

PYRO, Tank—20 Minutes—65°—Plates or Films**5x7 Tank Powder**

Pyro.....	30 grains
Sodium Sulphite.....	115 grains
Sodium Carbonate.....	75 grains
Hydroquinon.....	8 grains

8x10 Tank Powder (Tank holds 160 ounces)

Pyro.....	75 grains
Sodium Sulphite.....	$\frac{5}{8}$ ounces
Sodium Carbonate.....	$\frac{5}{16}$ grain
Hydroquinon.....	15 grains
Bromide.....	q. s.

PYRO-METOL, Tank—Keeps Well—Plates or Films

A Water (hot).....	2 quarts
Sodium Sulphite.....	$12\frac{3}{4}$ ounces
When dissolved add:	
Sodium Bisulphite.....	3 ounces
Boil 5 minutes and cool, then add:	
Pyro.....	2 ounces
Metol.....	100 grains
B Sodium Carbonate.....	5 ounces
Potassium Iodide.....	10 grains
(Or Bromide 10 ounces)	
Water.....	16 ounces

Add "B" to "A" Amber Solution results.

BROWN TONES IN DEVELOPMENT**Gaslight and Bromide Papers**

Water.....	35 ounces
Sodium Sulphite.....	3 ounces
Sodium Carbonate.....	5 ounces
Glycin.....	420 grains
Hydroquinon.....	134 grains
Potassium Bromide.....	62 grains

For Rich Dark Browns take 1 part of the above to 7 of water.

For Neutral Art Gravure effect use 1 part to 15 of water.

This developer requires no over-exposure. Those developers which call for excessive exposures and prolonged development not only block up the shadows but give prints of doubtful durability.

It has been suggested that 3 ounces 300 grains of Potassium Carbonate substituted for the Sodium Carbonate, and the addition of 4 ounces of Glycerine makes for better tones and greater efficiency. Our experience with the original formula was wholly satisfactory. Experiment for the best exposure suited to this developer on each brand of paper used.

RODINOL—Plates, Films and Papers

Rodinol is a trade name and the developer sold under its patent is splendid. The alkali used in compounding it is Lithium Hydroxide, which is very dear and almost unobtainable in most places. The following formula will, however, give a solution which keeps well, acts similarly and may be used just like Rodinol.

Distilled Water (warm).....	625 ccm.	or	11 ounces
Potassium Metabisulphite.....	50 grams	or	90 grains

When completely dissolved add:

Paramidophenol-hydrochloride..	50 grams	or	385 grains
Potassium Metabisulphite.....	125 grams	or	120 grains

When completely dissolved add the following solution slowly until the precipitate forms and re-dissolves.

Sodium Hydroxide.....	215 grams	or	3½ ounces
Water.....	500 ccm.	or	8¾ ounces

Then add water to make 1000 ccm. or 16 ounces.

Bottle in small containers and cork and seal.

To use: Take 1 part of the stock solution to from 10 to 40 parts of water. Plates and Films require the stronger mixture.

Beware of adding more of the Hydroxide than is required to re-dissolve the precipitate.

SHORT STOP FORMULA SB-1

	Avoirdupois	Metric
Water.....	32 ozs.	1 liter
Acetic Acid (28%).....	1½ ozs.	45 c.c.

The use of an acid short stop between developing and fixing is advisable. We strongly recommend rinsing prints in a solution made according to the above formula, as its action instantly checks development and prevents uneven spots and streaks when prints are immersed in the fixing solution.

Use a fresh bath for each batch of prints, as the acid will become neutralized by the alkali from the developer. This formula is sufficient for approximately sixty 4 x 6 prints.

HAND STAIN REMOVER FORMULA S-5

Solution A—	Avoirdupois	Metric
Potassium Permanganate.....	¼ oz.	7.5 grms.
Water.....	32 ozs.	1 liter
Solution B—		
Sodium Bisulphite.....	16 ozs.	450 grms.
Water.....	32 ozs.	1 liter

To use: Rub hands with a small amount of Solution A, rinse promptly in water and then with solution B, which will remove the stains. Then wash hands well under the tap.

FIXING

The simplest fixing bath is composed of 4 ounces of Hypo to 16 ounces of water; one in four. For Bromide Papers one in five or six is plenty strong.

Do not be deceived into thinking this bath retains the values you see on the negative or positive as it leaves the developer. Its action is one of slight intensification and warmer tones.

The addition of Sulphite (2 to 4 ozs.) tends to softness and neutral tones.

The addition of Sodium Chloride (6 to 8 ounces) increases softness and tends to blueness.

Iodide of Potassium (60 to 120 grains), softer results and warmer tones.

Nitrate of Silver $\frac{1}{4}$ ounce, and salt $\frac{1}{4}$ ounce added separately, salt first, intense contrast and blue tones.

Nitrate of Silver $\frac{1}{4}$ ounce, Potassium Iodide $\frac{1}{4}$ ounce added separately, Iodide first, most contrast, warm tone.

Alum and Acetic Acid, usual formula Purplish.

DEDUCTION

The combination of Plain Hypo with the Eastman Hardener (F14A) composed of Sulphite, Alum and Acetic Acid, averages best results as to efficiency, tone, and color. It hardens the emulsion.

FIXERS

Water.....	64 ounces
Epsom Salts.....	4 ounces
Hypo.....	20 ounces
For plates—full strength. For paper—1 part to 3 of water.	

HYPO PLAIN

Most formulae read 1:4 but 1:6 or 1:8 is strong enough for Bromide Papers.

ACID HARDENER

First dissolve Alum in warm water, then add acid and immediately thereafter the sulphite or the Alum will crystallize.

Chrome Alum Hypo to make 2 gallons:

A	Hypo.....	4 pounds
	Water.....	160 ounces
	Sulphite Soda.....	4 ounces
	Water.....	32 ounces
B	Chrome Alum.....	4 ounces
	In Water.....	56 ounces
	Sulphuric Acid.....	$\frac{1}{2}$ ounce
	In Water.....	8 ounces

Add "B" to "A" slowly while stirring.

I want to go on record as favoring a plain Hypo bath with after treatment for hardening, if quality and values are sought.

CHROME ALUM RINSE BATH FOR ROLL FILM

Formula SB-2

To Make	1 Gal.	10 Gals.	14 Gals.	24 Gals.	29 Gals.	42 Gals.	48 Gals.
Water.....	64 ozs.	5 gals.	7 gals.	12 gals.	15 gals.	20 gals.	24 gals.
Potassium Chrome Alum							
Pure.....	2 ozs.	1¼ lbs.	1¾ lbs.	3 lbs.	3¾ lbs.	5¼ lbs.	6 lbs.
Acetic Acid 28 %.....	3 ozs.	30 ozs.	42 ozs.	72 ozs.	87 ozs.	1 gal.	1gal.16oz.
Water to make.....	1 gal.	10 gals.	14 gals.	24 gals.	29 gals.	42 gals.	48 gals.

The chrome alum rinse bath may be used instead of plain water. Films may be transferred directly from the developer, and should remain in the bath for three to five minutes, then be immersed directly in the fixing bath.

It is important, however, that the films be agitated when they are first placed in the rinse bath or blistering may occur. Also in very warm weather, especially where it is difficult to control the temperature, it is sometimes necessary to reduce the acid content to one-half of that given in the above formula or to rinse the films in water before placing them in the Chrome Alum Rinse Bath in order to avoid blistering. These are more apt to occur when an old, weak, and exhausted developer is used.

The rinse bath should be tested from time to time with litmus paper and kept in an acid condition by the addition of a few ounces 28% Acetic Acid once or twice a week, the amount to be added depending on the number of rolls developed.

FIXERS

CHROME ALUM

A	Hypo.....	3½ pounds
	In Water.....	140 ounces
	Sodium Sulphite.....	3½ ounces
	In Water.....	28 ounces
B	Chrome Alum..	3½ ounces
	In Water.....	42 ounces
	Sulphuric Acid.....	½ ounce
	In Water.....	14 ounces

Add "B" to "A" slowly while stirring.

FIXING BATH—RAPID

Hypo.....	4 ounces
Ammonium Chloride.....	1 ounces
Water.....	20 ounces

This fixes in about half the time and washes out in about two-thirds the time of the usual fixing baths.

TEST FOR HYPO BATH

Any old, undeveloped film or plate, however spoiled, when cut into strips, may be used to test the fixing bath for exhaustion. After fixing a number of prints and when in doubt, drop a strip into the hypo. If complete clearing takes longer than ten minutes, discard the Hypo solution as exhausted.

Do not economize on Hypo. It is cheaper than the cost of spoiled material. Old Hypo is not only useless—it is bad.

FIXING BATH FOR VITAVA, VELOX, AZO AND BROMIDE PAPERS

Water.....	64 ounces
Hypo.....	16 ounces

When thoroughly dissolved, add the entire amount to the following hardening solution:

Water.....	5 ounces
Sodium Sulphite.....	1 ounce
Acetic Acid (28% pure).....	3 ounces
Powdered Potassium Alum.....	1 ounce

It is a great convenience to have a stock solution of this hardener on hand. It keeps well in a corked container and is always ready for use.

A fixing bath is quickly made by adding one part of this hardener to eight parts of hypo solution.

STOCK HARDENER

Dissolve in order named:

Water (about 100° F.).....	56 ounces
Sodium Sulphite	16 ounces
Acetic Acid (28% pure).....	48 ounces
Powdered Potassium Alum.....	16 ounces
Cold Water to make.....	1 gallon

Thoroughly dissolve the sulphite before adding the acid. Stir the solution until chemicals are well mixed. Continue stirring while adding the alum. When this chemical is entirely dissolved, add cold water to the solution to make up the final volume.

One gallon of fixing solution prepared as described, will fix approximately four gross 4x6 prints, or their equivalent in other sizes.

DEEP TANK FIXING BATH AND HARDENER FOR ROLL FILM

To make	10 Gals.	14 Gals.	24 Gals.	29 Gals.	42 Gals.	48 Gals.
Water	6 gals.	8 gals.	15 gals.	15 gals.	30 gals.	30 gals.
Hypo	20 lbs.	28 lbs.	48 lbs.	58 lbs.	84 lbs.	96 lbs.

Thoroughly dissolve the hypo, then add the following quantity of Stock Solution Hardener.

Hardener	1 gal.	1 ½ gals.	2 ½ gals.	3 gals.	4 gals.	5 gals.
Add water						
to make	10 gals.	14 gals.	24 gals.	29 gals.	42 gals.	48 gals.

N. C. FILM HARDENER

	To Make	1 Gal.	2 Gals.	5 Gals.	10 Gals.
Water.....		40 ozs.	80 ozs.	1 ½ gal.	3 gals.
Sodium Sulphite (E.K.Co.).....		10 ½ ozs.	21 ozs.	3 ¼ lbs.	6 ½ lbs.
Acetic Acid 28% Pure (E.K.Co.)...		64 ozs.	1 gal.	2 ½ gals.	5 gals.
Potassium Alum, Powdered.....		21 ozs.	42 ozs.	6 ½ lbs.	13 lbs.
Water to Make.....		1 gal.	2 gals.	5 gals.	10 gals.

To make up the solution, dissolve the chemicals in the order given, using water at about 100 degrees Fahrenheit, and being sure that the Sodium Sulphite has completely dissolved before adding the Acetic Acid. After the Sulphite-Acid solution has been thoroughly mixed, add the Potassium Alum. When this has dissolved, make up to the final volume with cold water.

A SUPPLEMENTARY HARDENER
F-20

Recommended for Bromide papers when necessary to overcome the tendency to stick to the belts of heated belt dryers.

Solution A	Avoirdupois	Metric
Water (about 125°F.) (52°C.).....	32 ozs.	1 liter
Sodium Sulphite (E. K. Co.).....	1 ½ ozs.	45 grms.
*Acetic Acid 28% (E. K. Co.).....	2 ozs.	64 c.c.
Powdered Potassium Alum.....	4 ½ ozs.	135 grms.
Water to make.....	64 ozs.	2 liters

*To make 28% Acetic Acid from Glacial Acetic Acid, dilute three parts Glacial with eight parts of water.

Solution B:		
Hot Water (about 160°F.) (71°C.)..	16 ozs.	500 c.c.
Borax (E. K. Co.).....	1 oz.	30 grms.

When dissolved add:		
Cold Water to make.....	64 ozs.	2 liters

Then cool and add slowly to Solution A with constant stirring.

If these directions are followed a clear solution will be obtained, but if the borax solution, while still warm, is added to Solution A, a white precipitate will form which does not re-dissolve.

Fix prints in the regular fixing bath, rinse thoroughly and place in the above hardener for 5 to 10 minutes.

Wash thoroughly and remove surplus water before drying.

HYPO TEST FORMULA HE-1

To make Stock Solution	Avoirdupois	Metric
Potassium Permanganate.....	4 grns.	0.3 grms.
Sodium Hydroxide (Caustic Soda)..	8 grns.	0.6 grms.
Water (distilled) to make.....	8 ozs.	270 c.c.

To use take five ounces clear water in a clean glass or graduate and add one dram of the above, then add a small volume of the wash water. If a small percentage of hypo is present, the violet solution will turn green and with larger concentrations of hypo, the green color will turn deep yellow.

In the preservation of negatives and prints proper fixation is essential. Hypo does that, but when left in the emulsion it goes right on working overtime and ruins. It fixes, good and plenty.

LOCAL REDUCING

This adjunct to retouching has been much discussed. If chemical reduction be meant my advice is to leave it alone, but there is much to be said in favor of abrasive methods.

LOCAL INTENSIFICATION

What has been said of chemical reduction holds true of chemical intensification. Avoid it. You will find any really high grade Red and Blue Ink invaluable in holding back parts of the negative which through being too thin give blocked-up shadows.

Dilute the ink to a faint tinge of color with distilled water to which a trace of Ammonia has been added, say one drop of Ammonia to a teaspoonful of water. When to use red and when blue will come to you with practice. The quality, the color, the subject matter of the negatives will be governing factors.

Some workers advocate tinting on a dry negative, many insist the plate should be soaked and the surface moisture blotted off with a clean, soft chamois skin. Use your own judgment. Try both and decide.

Be assured that no time is gained by putting on a deep color. You risk spoiling. Use the faintest tint and go over and over until sufficient body is built up. If, in the worst contingency, you have been indiscreet, soak the negative in water slightly acidulated with Acetic Acid and the dyes will melt out.

Use a fine Camel's Hair or Sable Brush.

REDUCER—Belitzski—Plates and Films

Potassium Ferric Oxalate.....	192 grains
Water.....	4 ounces

When dissolved add:

Sodium Sulphite (anhydrous).....	77 grains
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When dissolved add:

Oxalic Acid.....	57 grains
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Shake until of a bright green color, filter and add:

Hypo.....	2 ounces
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Shake until dissolved, filter again and bottle for use. Keep in the dark. It remains good and may be used, over and over, until it turns yellow, which denotes exhaustion.

REDUCER TO LESSEN CONTRAST—Plates and Films

Ammonium Persulphate.....	120 grains
Sodium Sulphite (anhydrous).....	19 grains
Sulphuric Acid (C. P.).....	18 minims
Water (distilled).....	4 ounces

To use, take one part of the above to 5, 6, 7, 8, or 9 parts water. Remove before reduction has quite reached the desired stage and wash promptly. This stock solution will keep for several months but will probably work more energetically the older it gets. When its action is found to be too radical discard and mix a fresh supply.

REDUCER—Farmer—Plates and Films

The approved formula is to add a certain amount of one to a given amount of the other of the following chemicals, but a rule that will fit any work-room and need is to make a one-in-five solution of Hypo and tint it faintly with Ferricyanide of Potassium. The darker the tint the more aggressive the action.

This eats out the half-tones and clear parts of the negative, thus increasing contrast. Good for line drawing, copying negatives. It also removes fog.

REDUCING BY FRICTION

Wet a clean piece of muslin or chamois skin with Alcohol and rub lightly and briskly over the parts to be reduced. This is done by drawing the cloth tightly over the index finger. Change to a clean spot frequently and keep moist with the alcohol. The abrasive reducer given in another place in this book will also be found useful. Work lightly and remember—haste makes waste.

REDUCER AND STAIN REMOVER—Plates or Films

Potassium Permanganate (5% solution)	2 drops
Sulphuric Acid (10% solution)	5 drops
Water	10 ounces

For vigorous reduction use full strength.

Use on dry negative without soaking.

This also removes stains.

INTENSIFIER, Amidol—Great Density—Plates or Films

A Potassium Bichromate	4 drachms
Water	5 ounces
B Hydrochloric Acid (C. P.)	4 drachms
Water	5 ounces

For use: 4 ounces "A" to 3 drachms "B" and add Water 16 ounces. Bleach thoroughly and re-develop in any good Amidol developer.

Increase of the Hydrochloric Acid content and decrease of the water dilution of the bleacher decreases the density of the intensification.

INTENSIFIERS, Amidol—Bromide Papers

Soak print in water till limp, then bleach in:

Water	10 ounces
Potassium Bichromate	50 gr.
Hydrochloric Acid	$\frac{1}{4}$ ounce

Wash till cleared and re-develop in daylight with any normal Amidol or M. Q. developer with NO Bromide.

INTENSIFIER AMIDOL—Bromide Paper

Soak Print in water till limp, then bleach in:

Water.....	10 ounces
Bichloride Mercury.....	½ ounce
Hydrochloric Acid.....	30 minims

Wash for five minutes and re-develop:

Amidol.....	mustard spoonful
Sodium Sulphite.....	tea spoonful
Sodium Bisulphide.....	30 grains
Water.....	3 ounces

CHROMIUM INTENSIFIER—Plates and Films

After washing out the Hypo more or less the negative is ready for treatment, or if dry, soak until thoroughly saturated and then proceed.

A Potassium Bichromate.....	192 grains
Water.....	8 ounces
B Hydrochloric Acid.....	¾ ounces
Water.....	8 ounces

To use, take A, 2 parts; B, 2 parts; Water, 1 part. When bleached through to the glass, wash thoroughly and redevelop in Amidol developer without Bromide and in diffused daylight.

INTENSIFIER, Pyro—Fine Grain—Plates or Films

A Potassium Ferricyanide.....	1 ounce
Water to.....	10 ounces
B Potassium Bromide.....	1 ounce
Water to.....	10 ounces
C Potassium Bichromate.....	1 ounce
Water to.....	10 ounces
D Metabisulphite.....	1 ounce
Pyro.....	1 ounce
Water to.....	8 ounces
E Ammonia (stronger).....	1 ounce
Water to.....	10 ounces

For slight intensification bleach in 2 drachms of each "A" and "B" and 2 ounces water. When thoroughly bleached wash by yellow light till clear of stain and re-develop in 1 drachm each of "D" and "E" and 2 ounces of water in bright daylight till whiteness is gone when viewed from glass side.

For greater intensification (stain dye) re-develop in 2 drachms "D", 4 drachms "E," 2 ounces water. Let this turn decidedly tinted by oxidization before putting in the bleached negative.

For very dense intensification take 2 drachms each of "A," "B," and "C" and add 2 ounces of water. Bleach in this and wash even more thoroughly before re-development, which carry out in bright daylight and rocking of the tray.

DRY CHROMATE INTENSIFIER—Plates and Films

Place 6 ounces of Hydrochloric Acid in an evaporating dish, add 600 grains of Ammonium Bichromate and on a sand-bath apply heat until dry. A few grains of this to the ounce of water will make the bleach which use as above. Wash and develop as directed.

INTENSIFIER—Bromides and Chlorides

O. V. Lange, writing in "Camera Craft," gives the following simple method of intensifying bromides:

"A few days back I had a bromide print that was a trifle weak; it was too late to make another exposure, so I put the print on a glass plate and poured on it a half-strength saturated solution of mercuric chloride. When it commenced to bleach, it was washed well, and then a weak solution of ammonia was poured over, and the result was just what was wanted. It had the property of warming up the general tone of the print, and as it was a portrait, it was decidedly beneficial."

NOTES ON INTENSIFICATION

My experience with intensifiers of my own compounding have not been uniformly satisfactory. The mercurial compounds acted perversely, the chromates were temperamental.

Manufacturers: Agfa, James H. Smith & Sons, Burroughs Wellcome—seem to know how to train their chemicals and I buy my intensifiers and reducers. They are cheaper in the long run because they do not spoil my negatives and do their work well.

STALE PAPERS

To reclaim paper spoiled by time or moisture soak each sheet for a minute in:

Potassium Permanganate.....	5 grains
Hydrochloric or Sulphuric Acid.....	30 minims
Water.....	10 ounces

Rinse for a minute or two in water and soak for an equal length of time in:

Sodium Sulphite.....	40 grains
Water.....	10 ounces

Wash for five minutes, hang in the dark to dry and pack away for future use or the wet paper may be pinned to the enlarging board (if Bromide paper) and an enlargement made forthwith.

The time of exposure must be doubled as the paper loses sensitivity by about one-half.

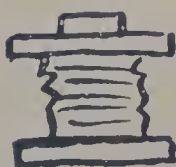
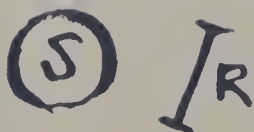
The above and a maximum of Potassium Bromide in the developer may salvage paper otherwise wasted. Such paper may also be fixed out and sensitized with Blue Print or Kallotype sensitizers—thus becoming a new product.



PORTRAIT BY J. ANTHONY BILL



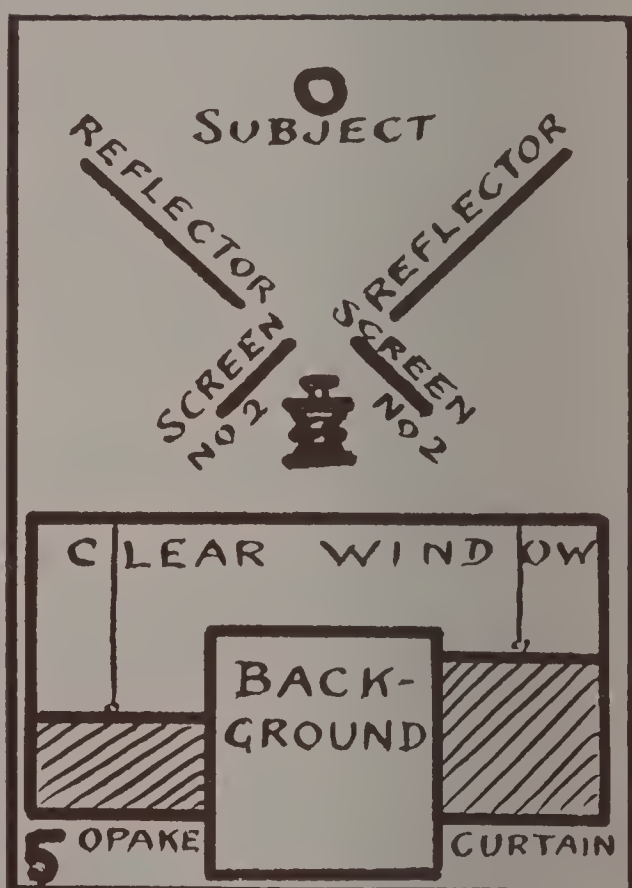
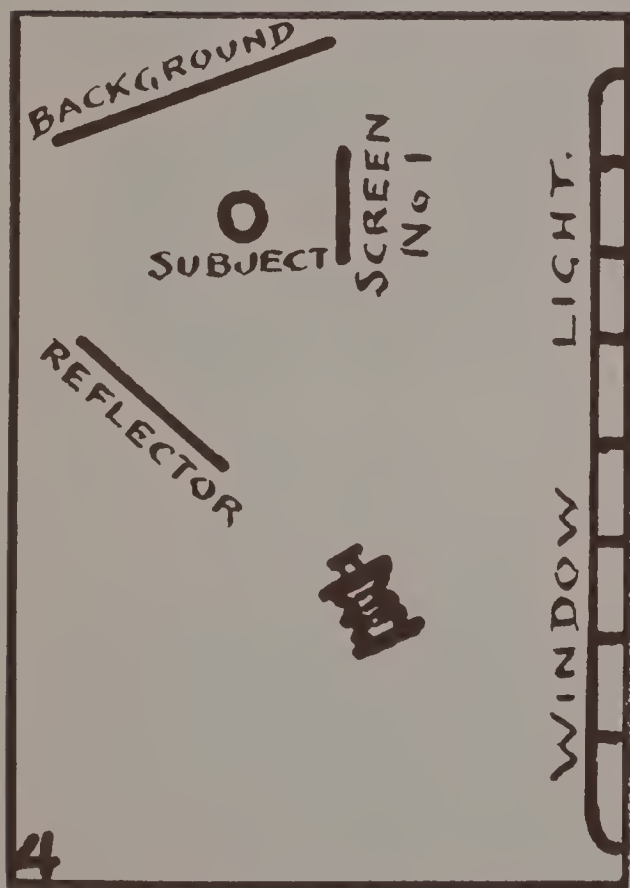
Twin Arc
LAMP



Specially
EQUIPPED
CHILDREN'S
Studio
Bright
Lighting



PORTRAITS BY O. J. SMITH

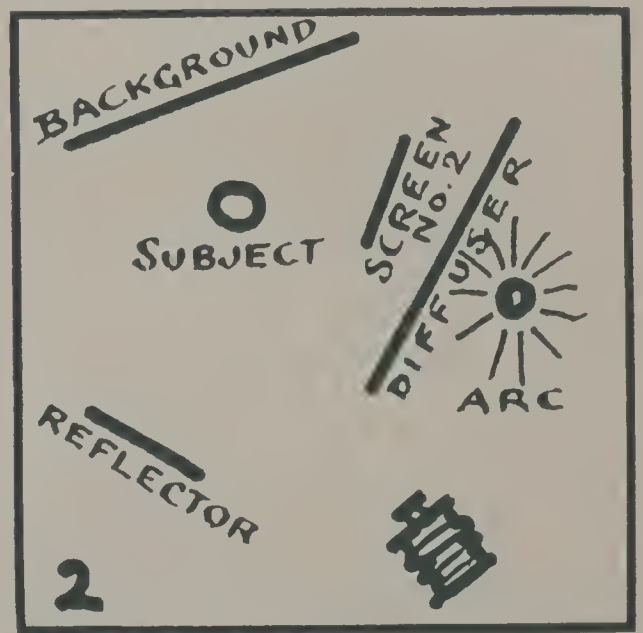
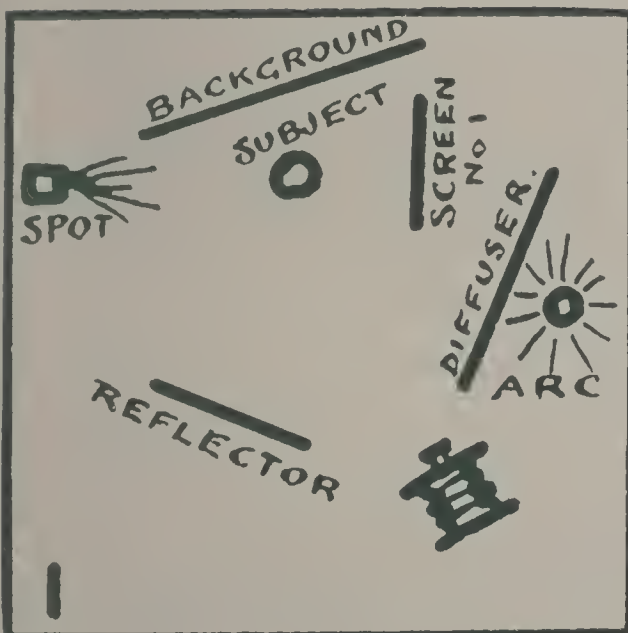


In the left hand portrait the window is clearglass, 12 feet wide by 9 feet high. Opaque curtain closing lower portion to height of 4 feet. Subject 7 feet from window.

Right hand portrait offers a decided novelty. The arrangement of reflectors and opaque screens is no less startling than the lighting.



PORTRAITS BY O. J. SMITH



Screen Number 1 in these cuts and in all succeeding is to be known as the India Linen, Black, Head-Screen.

Screen Number 2 is an opaque material intended to cut off the light.

In the left hand illustration, above, Screen No. 1 shades the face and neck.

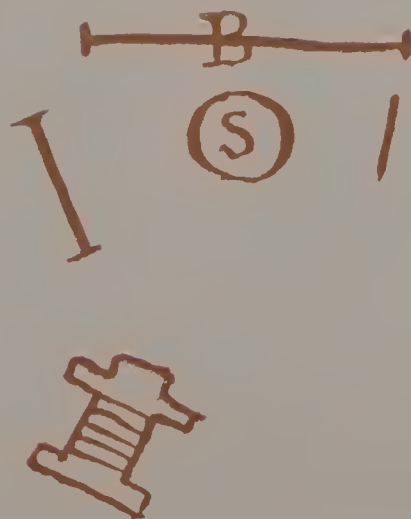
In the right hand illustration, Screen No. 2 shades the left shoulder.

Negatives made on Eastman Portrait Films.



PORTRAIT BY J. ANTHONY BILL

SUBJECT
10 Feet
from
LIGHT



BROMIDE TONERS (O. Kuhne Formula)—Hydroquinone

Put print into this until desired color.

Water.....	200 ounces	or	20 ounces
Bromide Potassium.....	5 ounces	or	½ ounce
Hydroquinone.....	1 ounce	or	45 grains

It will tone a good reddish black and harden the emulsion wonderfully.

Purple Brown: Rinse from above and put into any Amidol developer.

Bartolozzi—Red. Work with perfectly washed and dried prints.

A	Water.....	10 ounces
	Ammonia Carbonate.....	2½ ounces
	Copper Sulphate.....	100 grains
	Potassium Ferricyanide.....	250 grains

Dissolve the Copper Sulphate in as little water as possible separately. Also the Potassium Ferricyanide separately.

Add to the Ammonia Carbonate, slowly stirring:

B	Hypo.....	1 ounce
	Boric Acid.....	50 grains
	Water to.....	10 ounces
C	Ammonia.....	1 drachm
	Water.....	25 ounces

Put into "A" for shortest time necessary to tone. Fix in "B," clear in "C."
Rinse well between each operation.

A	Potassium Oxalate.....	120 minims.
	Copper Sulphate.....	24 minims.
	Acetic Acid.....	6 minims.
	Potassium Ferricyanide.....	18 minims.
	Ammonia Alum.....	60 minims.
	Water.....	10 ounces
B	Copper Sulphate.....	30 grains
	Sodium Chloride.....	6 grains
	Hydrochloric Acid.....	3 minims.
	Water.....	1 ounce

Tone in "A" until desired color. Fix and clear AFTER 5 minutes rinsing in "B."

Gold Tone—Red

Take the Sulfided prints and tone in this solution.

Add "A" to "B" slowly, stirring continuously.

A	Gold Chloride.....	2 grams
	Hot Water.....	1000 c.c.
B	Ammoniate of Potassium Sulfocyanite.....	12 grams
	Hot Water.....	1000 c.c.

Tones in 10 minutes.

RED TONER—Bromides

Copper Sulphate.....	20 grains
Potassium Ferricyanide.....	10 grains
Water.....	3 ounces

To the muddy solution add slowly a saturated solution Ammonium Carbonate till precipitate that first forms re-dissolves and liquid is clear greenish blue, then add one half ounce more of the Ammonium Carbonate.

Tone to the desired color and clear in:

Water.....	6 ounces
Ammonia.....	30 drops

TONER, Copper Red—Bromides and Chlorides

Water.....	30 c.c. or	1 ounce
Copper Sulphide (1:10).....	2 c.c. or	30 drops
Ammonia Oxalate (1:25).....	20 c.c. or	338 drops
Potassium Ferricyanide (1:5).....	2 c.c. or	30 drops
Chromic Acid (1:20).....	15 drops or	15 drops

TONER, Brown to Red—Bromides

Over-expose and develop in an Acidulated developer, using Citric Acid preferably.

TONER, Brown—Bromides

Bleach in:

Potassium Ferricyanide.....	$\frac{1}{2}$ ounce
Potassium Bromide.....	$\frac{1}{2}$ ounce
Water.....	4 ounces

Re-develop in:

Sodium Sulphite.....	1 part
Water.....	100 parts

SEPIA TONER

Potassium Hydroxide.....	1 ounce
Water.....	10 ounces

While boiling add flowers of Sulphur (resublimed Sulphur) until no more will dissolve. Cool, filter and bottle. To use, take about one ounce to 20 of water.

VELVET TONER—Improves Any Print—Bromides

Bleach in:

Potassium Bichromate.....	100 grains
Water.....	10 ounces
Hydrochloric Acid.....	$3\frac{1}{2}$ drams

Wash for five minutes and re-develop in any Amidol Developer.

SULFIDE TONING
BLEACH

Potassium Ferri Cyanide.....	1 ounce
Potassium Bromide.....	1 ounce
Water.....	24 ounces

Use: 1 ounce of above, 1 ounce water, 1 drop Ammonia.

RE-DEVELOPER

Sodium Sulfide.....	1 ounce
Water.....	12 ounces

Use: 1 ounce of above, 8 ounces water.

IMPROVED BLEACHER

Potassium Bichromate.....	3 drachms
Sulphuric Acid.....	1¼ ounces
Sodium Chloride.....	2 ounces
Water.....	1 pint

Use with equal parts water. Clear yellow stain in table salt water. Rinse in clear water.

Re-develop in Sulfide. If the bleach should spot and mottle it does not matter.

HYPO-ALUM TONING BATH
FOR SEPIA TONES ON VITAVA AND AZO PAPERS
T-1a

	Avoirdupois	Metric
Cold Water.....	90 ozs.	2700 c.c.
Hypo.....	16 ozs.	450 grms.
Dissolve thoroughly and add the following solution:		
Hot Water (about 160°F.) (71°C.)..	20 ozs.	600 c.c.
Powdered Potassium Alum.....	4 ozs.	120 grms.

Then add the following solution (including precipitate) slowly to the above hypo-alum solution while stirring the latter rapidly.

Cold Water.....	2 ozs.	60 c.c.
Silver Nitrate Crystals.....	60 grns.	4 grms.
Sodium Chloride (Table Salt).....	60 grns.	4 grms.
After combining above solutions, add		
water to make.....	1 gal.	4 liters

Note—The silver nitrate should be completely dissolved before adding the sodium chloride, and immediately afterwards the solution containing the milky white precipitate should be added to the hypo-alum solution as directed above. The solution should be milky white if correctly mixed.

To use, heat in a tray on a water bath to 120°F. (49°C.), never higher than 130°F. (54°C.), and tone for 12 to 15 minutes. If prints have been dried, they should be thoroughly soaked in water before toning. The black prints should be a shade darker than desired in the finished print and fully and evenly developed. When toned, place in warm water and sponge off any sediment. Wash for one hour in running water.

SEPIA RE-DEVELOPER FOR VELOX, AZO AND BROMIDE PAPERS

T-7

No. 1 Stock Bleaching Solution	Avoirdupois	Metric
Potassium Ferricyanide	2½ ozs.	75 grms.
Potassium Bromide	2½ ozs.	75 grms.
Water	64 ozs.	2 liters
No. 2 Stock Re-Developing Solution		
Sodium Sulphide (not sulphite)	1½ ozs.	45 grms.
Water	16 ozs.	500 c.c.

BLEACHING BATH

Stock Solution No. 1	16 ozs.	500 c.c.
Water	16 ozs.	500 c.c.

RE-DEVELOPER

Stock Solution No. 2	4 ozs.	120 c.c.
Water	32 ozs.	1 liter

MANIPULATION

1.—Immerse print, which should first be thoroughly washed, in the bleaching bath, allowing it to remain until only faint traces of the half-tones are left and the black of the shadows has disappeared. This operation will take about one minute.

Note—Particular care should be taken not to use trays with any iron exposed, otherwise blue spots may result.

2—Rinse Thoroughly in clean, cold water.

3—Place in re-developing solution until original detail returns (for about 30 seconds). Immediately after the print leaves the re-developer, rinse thoroughly, then immerse it for five minutes in a hardening bath composed of Hardener 1 ounce (Formula F-1a), Water 16 ounces, then remove print from this bath and wash it as usual. The color and gradation of the finished print will not be affected by the use of this bath.

4—Wash for half an hour in running water.

TONING IN DEVELOPMENT—Bromides and Chlorides

Water	1000 ccm.
Sodium Sulphite	55 grams
Glycine	3 grams
Hydroquinon	10 grams
Potassium Hydroxide	50 grams
Potassium Bromide	1½ grams

To use:

For Brown Black overexpose 2 times

For Brown overexpose 3 times

For Red Brown overexpose 4 to 8 times

For Orange overexpose 8 to 20 times

Needs some slight modifying to suit different brands of papers.

GOLD MEDAL TONING BATH
T-13

	Avoirdupois		Metric
Stock Solution No. 1	32 ozs.	1 gal.	1 liter
Boiling Water.....	32 ozs.	1 gal.	1 liter
Hypo.....	4 ozs.	16 ozs.	120 grms.
Powdered Potassium Alum.....	½ oz.	2 ozs.	15 grms.
Boil two minutes, allow to cool and add:			
E. K. Co. Sodium Phosphate (Dibasic)	½ oz.	2 ozs.	15 grms.

Test with Red Litmus paper. If the paper does not turn blue in one minute add Sodium Phosphate in the above mentioned quantities until it does. Then prepare the following solutions:

	Silver Nitrate Crystals.	15 grns.	60 grns.	1 gm.
	Water.....	¼ oz.	1 oz.	7.5 c.c.
and:	Potassium Bromide....	45 grns.	180 grns.	3.1 grms.
	Water.....	¼ oz.	1 oz.	7.5 c.c.

Pour the Bromide solution in the Silver solution and immediately add the mixture with the precipitate to the cool hypo-alum bath.

The bath must be cool when these solutions are added.

	Avoirdupois	Metric
Stock Solution No. 2		
Water.....	2 ozs.	60 c.c.
Gold Chloride.....	15 grns.	1 gm.

To tone use:

No. 1 Solution.....	16 ozs.	400 c.c.
No. 2 Solution.....	1 drm.	3 c.c.

Heat the bath to a temperature of 120° to 125°F. (49° to 52°C.) and place all the prints to be toned in the bath at once. Keep prints separated. Toning will require about 20 minutes.

TONER, Violet Brown—Bromide Papers

Potassium Chloride Solution (1:10).....	600 c.c.
Copper Sulphate (1:10).....	80 c.c.
Potassium Ferricyanide (1:10).....	70 c.c.
Water to make double the quantity. This intensifies.	

FERRICYANIDE-AMMONIUM BLEACHER

Ammonium Carbonate.....	40 grains
Potassium Ferricyanide.....	10 grains
Water.....	1 ounce

FERROUS SULPHATE TONER

Ferrous Sulphate.....	10 grains
Hydrochloric Acid.....	5 minims
Water.....	1 ounce

TONER, Purple Brown—Bromides and Chlorides

Sodium Sulfide.....	50 grams
Ammonia Sulfocyanide.....	100 grams
Ammonia.....	95 grams
Water to.....	1000 c.c.

Tones without bleaching.

GREEN TONER FOR BROMIDE PAPER

Wash thoroughly to free from Hypo.

Soak for 5 minutes in a Normal Sulfide Bath, as follows:

Bleach in the Ferri Cyanide-Ammonium Bath, as follows:

Wash until yellow stain is fully removed.

Tone in Ferrous Sulphate Bath.

Wash for 10 minutes.

TONER, Kugler Formula; Green—Bromides

Bleach in:

Potassium Ferricyanide.....	5 grams or 77 grains
Water.....	100 ccm. or 3 ounces
Ammonia.....	5 drops or 5 drops

Bleach until light gray brown. Wash until stain is out, then tone for 5 minutes in Blue Tone:

Citrate Iron and Ammonia.....	2 grams or 30 grains
Water.....	100 ccm. or 3 ounces
Hydrochloric acid.....	5 ccm. or 25 minims

Rinse briefly and complete for 5 minutes in:

Sodium Sulfide.....	1 gram or 15 grains
Water.....	100 ccm. or 3 ounces
Hydrochloric Acid.....	5 ccm. or 25 minim.

TONER, Green—Bromide Papers

Bleach in:

Potassium Bromide.....	20 grains
Potassium Ferricyanide.....	100 grains
Water.....	8 ounces

Wash until stain is removed, then re-develop in:

Cobalt Chloride.....	80 grains
Ferrous Sulphate.....	20 grains
Hydrochloric Acid.....	1½ drachms
Water.....	8 ounces

Toning takes 15 minutes.

TONER, Emerald—Bromide Papers

Re-develop in same as above only substitute 2 drachms Acetic Acid for the 1½ drachms of Hydrochloric Acid, and Fix in a plain Hypo bath.

TONER, Green—Bromides and Chlorides

For certain landscapes, marine views, moonlight effects, etc., a pronounced green tone is very suitable. The following process is recommended to produce this tone: Make a solution of 15 cc. of acetic acid in 150 cc. of water, divide the same into three equal parts, and dissolve 0.5 gram yellow prussiate of potassium in one; 0.5 gram of acetate of uranium in the second, and 0.5 gram chromatic oxide of iron in the third part. After complete solution, pour the contents of the three dishes into a tray, mix well and put the picture into this solution, leaving there until the desired tone has been obtained. Afterwards wash well. The whole process should be washed in subdued (candle or kerosene) light.

TONER, Malachite Green—Bromide Papers

Uranium Nitrate Solution (1:100).....	25 c.c.
Citrate Iron and Ammonia (1:100).....	25 c.c.
Acetic Acid.....	10 c.c.
Potassium Ferricyanide (1:100).....	50 c.c.

GASLIGHT TONERS

**For Arturo, Vittel, Cyko Enlarging and all Chlorides.
Green**

A Potassium Bichromate.....	20 grains
Potassium Ferri Cyanide.....	100 grains
Water.....	8 ounces

Bleach print in this about 3 minutes.

Wash until stain is entirely gone.

Tone in:

B Cobalt Chloride.....	80 grains
Ferrous Sulphate.....	20 grains
Muriatic Acid.....	1 1/3 drams
Water.....	8 ounces

“A” will take 10 or 15 minutes to dissolve and as long to bleach.

Wash for 10 or 15 minutes and fix in Hypo 1:10.

NOTES: The longer the bleaching in “A” the lighter the green. Substitute Acetic for Muriatic and get Emerald Green, using 2 drams Acetic to the 8 ounces water.

TONER, Green—Bromides and Chlorides

Ten percent solutions of:

- A** Uranium Nitrate
- B** Ammonia Citrate Iron
- C** Potassium Ferricyanide
- D** Nitric Acid

Take “A” and “B” 12 drops each; “C” and “D” 24 drops each. Water to make 1 ounce. This intensifies the print.

TONER, Blue—Bromide Papers

Water.....	32 ounces
Potassium Ferricyanide.....	12 grains
Ammonia Ferric Citrate.....	12 grains
Nitric Acid C. P.....	24 drops

Wash for at least twenty minutes.

TONER, Blue—Bromides

Citrate Iron and Ammonia.....	$\frac{1}{4}$ ounce
Potassium Ferricyanide.....	$\frac{1}{4}$ ounce
Glacial Acetic Acid.....	$\frac{1}{2}$ ounce
Water.....	10 ounces

TONER, Blue—Bromides and Chlorides

Soak print in dilute Acetic Acid, then tone as below:

A	Ammonia Ferricyanide Citrate.....	10% solution
	Hydrochloric Acid.....	10% solution
	Equal parts.	
B	Potassium Ferricyanide.....	1 ounce
	Water.....	9 ounces

Use "A" 1 part, "B" 2 parts. If too quick in action dilute. Wash for at least 20 minutes or in 10 changes of plenty of water.

TONERS, Various Colors—Bromides and Chlorides

NOTES: Best tones are gotten if exposure was right and development complete.

BLUMANN FORMULAE

A	Water.....	$3\frac{1}{2}$ ounces
	Nitrate or Acetate Uranium	20 grains
	Glacial Acetic Acid.....	$\frac{1}{2}$ ounce
B	Water.....	$3\frac{1}{2}$ ounces
	Ferricyanide Potassium.....	20 grains
	Glacial Acetic Acid.....	$\frac{1}{2}$ ounce
C	Water.....	$3\frac{1}{2}$ ounces
	Citrate Iron and Ammonia.....	20 grains
	Glacial Acetic Acid.....	$\frac{1}{2}$ ounce
	Blue: "B" 1 part "C" $1\frac{1}{2}$ parts	
	Green: "A" 1 part "B" 1 part "C" 1 part	
	Sepia: "A" 2 parts "B" 1 part	
	Red: "A" 1 part "B" 1 part	

Be sure prints are free from Hypo.

Wash after toning in several changes of slightly Acetic Acidulated water.

Fix and clear in weak Alum water.

TONING, By Redevelopment—Bromides and Chlorides**Eastman Bromide Formula****Bleacher**

A Potassium Ferricyanide.....	5 ounces
Potassium Bromide.....	5 ounces
Water.....	120 ounces

Re-develop in:

B Sodium Sulphide.....	5 ounces
Water.....	60 ounces

Use: Take Stock Solution "A".....	4 ounces
Water.....	4 ounces

Rinse until last trace of yellow is gone, then re-develop in:

Stock Solution "B".....	1 ounce
Water.....	8 ounces

Remove and without rinsing put in:

Velox Acid Hardener.....	1 ounce
Water.....	16 ounces

After 5 minutes wash thoroughly, or harden in Alum Solution, and then wash.

IMPROVERS—Bromide Papers

Several correspondents having written for help in the matter of preserving the "juicy" appearance which bromide prints have when fresh, we may publish the reply for the information of every reader.

This is generally the fault of over-exposure; but great improvement can be affected by laying the print face upwards, after washing, on a sheet of glass, and brushing over with the following solution when it has cooled:

Potassium Sulphocyanide.....	30 grains
Chloride of gold.....	2 grains
Boiling Water.....	4 ounces

The print must be well washed afterward. If the print is weak and thin looking, then possibly the following may be useful:

Potassium Sulphocyanide.....	60 grains
Mercuric Chloride.....	15 grains
Distilled Water.....	3½ ounces

Just before use, add a few drops of chloride of gold solution to a little of the above and brush over the print; then rinse well and re-fix.

REDUCER AND CLEARER—Bromide Papers

This will retrieve many a spoiled sheet of paper.

Make a saturated solution of Iodide of Potassium. In another vessel put 1 drachm of Iodide flakes in 1¾ ounces of water and add to this a little at a time and with constant stirring the Iodide Solution until the Iodine flakes dissolve, or:

Water.....	2 ounces
Iodine.....	1 drachm

Add Iodide of Potassium a few crystals at a time until solution is achieved.
If the print turns blue fix in dry acid bath.

SENSITIZER—Blue Print

A	Citrate Iron and Ammonia.....	120 grains
	Water.....	1 ounce
B	Potassium Ferricyanide.....	105 grains
	Water.....	1 ounce
C	Oxalic Acid.....	30 grains
	Water.....	1 ounce

To use: A, 10 parts; B, 10 parts; C, 2 to 6 parts.

The more “C” the softer the prints: Too much will fog the whites. The separate solutions keep, but once mixed the solution must be used within a day.

SENSITIZER—Blue Prints

A	Citrate Iron and Ammonia.....	1 ounce
	Water.....	2 ½ ounces
B	Potassium Ferricyanide.....	1 ounce
	Water.....	8 ounces

Use: 1 part “A” to 2 parts “B.” Mix just before using.

SENSITIZER—Blue Prints

A	Iron Citrate Ammonia.....	120 grains
	Water.....	1 ounce
To this add Concentrated Ammonia till it smells of it.		
B	Potassium Ferricyanide.....	105 grains
	Water.....	1 ounce
C	Acid, Oxalic.....	30 grains
	Water.....	1 ounce

Separate the solutions. Will keep but they should not be mixed until ready to use.

To mix take 10 parts “A,” 10 parts “B” and add to 6 parts “C.” Use “C” with discretion, for it will cloud the whites.

TONING BLUE PRINTS

There are formulas said to turn Blue Prints Black, Sepia, and what not. Our most careful and persistent experiments, and the search of years for a truly satisfactory way of accomplishing the feat have resulted in partial success, at best. We therefore advise that if the reader desires prints in colors

he use other processes. A Blue Print is beautiful as such. Though held in contempt on account of its cheapness it is beautiful in its color and may be made so in its quality. Commercially, being cheap, there is no reason why the sensitizing should not be done with the solutions giving the best results, and with the care usually expended on more complicated processes.

For those who want to tone Blue Prints, here are some formulae:

BLACK TONE FOR BLUE PRINTS

Bleach in:

Borax.....	1 drachm
Concentrated Ammonia.....	1 drachm
Water.....	6 ounces

Wash well and re-develop in a saturated solution of Gallic Acid.

SEPIA TONER FOR BLUE PRINTS

Water.....	3 ounces
Tannic Acid.....	1 drachm
Hydrochloric Acid.....	8 drops

Use 1 drachm of the above to 6 ounces of water and soak the print in this 2 to 4 minutes: Wash well and tone to desired degrees in:

Potassium Carbonate.....	$\frac{3}{4}$ ounces
Water.....	15 ounces

Wash thoroughly and dry.

VIOLET TONER FOR BLUE PRINTS

Soak for 4 or 5 minutes in:

Water.....	95 parts
Borax.....	5 parts

Wash well and tone in:

Water.....	1 pint
Tannic Acid.....	$\frac{1}{2}$ ounce
Gallic Acid.....	$\frac{1}{2}$ ounce

NOTES ON BLUE PRINTS

The sensitizers may be applied to almost any paper without sizing, but a small amount of Gum Arabic in the solution helps wonderfully to keep the image on the surface.

It does not seem to be generally known that hard, calendered, or richly sized papers give greater contrast and that soft papers, even with surface sizing (unless Baryta coated), give softer prints and finer gradations.

The sizing may be achieved by adding Gum Arabic to the sensitizer or as a preliminary operation by dipping the paper in a very weak starch, arrow-root, or glue solution.

KALLITYPE—Sensitizer

Distilled Water.....	1 ounce
Ferric Oxalate.....	75 grains
Silver Nitrate.....	30 grains

Dissolve the Oxalate in tepid (not hot) water, adding a few grains of Oxalic Acid to hasten solution, filter rapidly and add the silver. Keep in brown bottle and allow it to ripen for a few days.

Developer**Black Tones:**

Borax.....	2 ounces
Rochelle Salts.....	1½ ounces
Water.....	20 ounces

Purple Brown Tones:

Borax.....	½ ounce
Rochelle Salts.....	2 ounces
Water.....	20 ounces

Sepia Tones:

Rochelle Salts.....	1 ounce
Water.....	20 ounces

Platinum Blacks:

Sodium Acetate.....	3 ounces
Water.....	20 ounces

In all the above a saturated solution of Bichromate of Potassium should be added drop by drop to the amount required to produce contrast and avoid fog. This acts as Bromide does in Bromide of Chloride emulsion developers.

Clearing Bath:

Oxalate of Potassium.....	1 ounce
Water.....	8 ounces

Fixing Bath:

Water.....	20 ounces
Hypo.....	1 ounce
Ammonia.....	125 minims

NOTES

The addition of a little Gum Arabic to the sensitizer will keep the image on the surface and render it more brilliant.

Apply with a rubber-bound Camel's Hair brush or an absorbent cotton mop. Dry in the dark and use within 24 hours of drying.

The same things apply to hard and soft papers as have been stated on page 39 of Blue Prints. Kallitype, however, is more sensitive to paper impurities.

PLATINUM PAPER

Adding a few drops of Potassium Chloro-platinate Solution to the Kallitype Sensitizer will give Platinum Papers.

SEPIA PAPER

Photo Miniature credits the following to the author, who hereby affirms that he evolved it from a paper once marketed by the Eastman Kodak Company. It is good if a true Sepia tone and broad effects are wanted.

Soak any hard gelatine in water, overnight—about 6 grains to the ounce. Next day complete solution by boiling in a double boiler. When cooled to a tepid temperature add in the order given and after each has dissolved:

Tartaric Acid.....	8 grains
Silver Nitrate.....	9 grains
Citrate of Iron and Ammonia.....	40 grains

Filter rapidly through absorbent cotton and keep in brown bottles.

Coat in the usual way and use as soon as possible after drying. If necessary to keep it should be packed face to face.

Prints develop in plain water like a Blue Print. Wash prints in several changes of water and fix in:

Water.....	2 ounces
Hypo.....	25 grains

A peculiar quality of this paper is that it goes on printing in the dark. Exposed under a negative for half the required time and put into a dark box it will be found over printed in the course of an hour or two.

The image shows as on Platinum Paper until developed, that is, a sort of grayish shadow on a yellow ground.

TONING KALLITYPES

All Iron Salt images may be toned in the old formulae of Gold Toners or Platinum, or in similar solutions in which the salts of Selenium, Paladium, or Uranium are substituted for the Gold or Platinum. The resultant tones and qualities are characteristically different and differently beautiful. In that Bichromate offers so ready a control in the sensitizer, in the developer, and as a local reducer, Kallitype is a particularly fit pictorial medium.

Kallitype may be made to yield fine detail and soft prints with a long range of tones, or broad, sketchy effects. This is achieved by the use of more or less Bichromate in the sensitizer and developer, by using smooth, hard, or rough, soft paper, and by using gum in the sensitizer. Bichromate makes for contrast. In toning, contrasty prints give the best results.

BROMOIL PROCESS

There is on the market a neat, substantial, and compact box known as the Drem Bromoil Outfit. It contains every item needed to supplement any equipped dark-room to carry on to completion the bromoiling of prints. The brushes are the Dr. Mayer bristle bromoil brushes and in fact the outfit is in every detail made under direction of the famous Viennese authority.

Outfit Recommended

Brushes: No. 20, No. 14, No. 8, No. 2, one of each. These may be the Fitch soft hair or the Mayer long bristle. Each have their special good qualities and each are favorites by various workers, respectively. The best Fitch brushes are the French, made by Bullier of Paris. The best bristle are the Drem or Mayer. Sinclair metal bound brushes are good but too heavy and the brass ferrule develops nasty verdigris.

Inks: Sinclair Bromoil Inks are by far the best. French Encre is excellent, as are the Drem Bromoil Colors. Any good lithographic or offset ink will work in the hands of an adept.

Palette Knife or Spatula: A small flexible one.

Bleaches: Can be bought in capsules or concentrated solutions. The Drem and Sinclair are very fine. May be compounded easily, quickly, and cheaply, as needed, at home.

Bromide Papers: Wellington Bromoil stands pre-eminently the one fool-proof paper with the least possibility of failure. P. M. C. numbers 5, 7 and 8; Mimosa semi-glossy; Gevaert numbers 42, 43, 47 and 48; Barnett ordinary, Smooth and Rough, Tiger-tooth, Platino-Mat and Cream Crayon; Ilford in most grades except the porcelain finishes; Ansco Bromides; Defender in those grades of Velour Black not characterized by porcelain surface or glossy; Haloid in Parchment and one or two of the rough grades; Charcoal Black "A" and "B".

BROMOIL PROCEDURE

Expose, develop, rinse, fix, wash thoroughly, dry; bleach, rinse, fix in one or two successive baths, wash fairly, dry; soak, blot off moisture, ink up, hop and clear, re-soak as needed, build up, hop and clean up; dry, de-fat, dry. Completed.

BROMOIL DEVELOPER

Amidol is recommended by every authority and while some advanced workers claim they can do with any developer except Pyro, all agree on Amidol.

Goetz uses 2 grains of Amidol and 10 grains of Sulphite to each ounce of water and no Bromide.

Dr. Mayer uses more Sulphite and prefers a faster developer to which he adds Bromide.

Sophie Lauffer likes the Mayer proportions in the main but adds **25 grains** of Citric Acid to 20 ounces of developer.

BROMOIL FIXER

After development the print should be fixed in the proportions of Hypo 1, Water 8, with slight acidulation of Acetic Acid or Sodium Bisulphite if desired, but not with Alum or other hardener.

After bleaching fix in an acid bath of Hypo 1, Sodium Sulphite and Sodium Bisulphite a little (it doesn't matter so long as the amount is not out of all reason); Water 10. Time about 5 minutes.

Goetz uses a plain Hypo bath only.

Takahashi insists on two successive fixings first in Hypo 1, Water 8 with 12 grains of Sulphite to each ounce of the solution and a second bath of Hypo 1, Water 8, with Sodium Bi-Sulphite 10 grains to the ounce.

SOAKING THE PRINT

Different papers require different treatment. With some three to five minutes in water at room temperature suffices, others call for long immersion—some up to an hour. The longer the soaking the greater the contrast. Extreme contrast may be achieved by adding a drop or two of Ammonia to each ounce of water in the soaking bath.

INKS

The stiffer and dryer the ink the greater the contrast. On papers with little or no evident relief and for soft effects use a thin ink. For papers with high relief and for more contrast use a hard or stiff ink.

Inks may be softened with Mediums supplied for the purpose. We have used many of the butter substitutes (Nucoa, Fluffo, Cottolene, etc.), Vaseline, and certain grades of lubricating pastes with success.

The important thing to know is that a mass of ink as big as a green pea may be softened by no more of the mediums mentioned than will adhere to a pin head. Use the softening material most sparingly or you will find your efforts in inking up produce only smudges.

LAYING ON THE INK

The ink having been spread out into an exceedingly thin layer on the palette, which may be a sheet of glassine paper, an old plate, or a piece of glass, or anything of that sort, the tips of the hairs of the brush are just touched to the ink, which is equalized by tapping the brush gently on a clean part of the palette.

Now gently lay the ink on the print by a patting motion. Kales gives a little side pressure or minute sweep to the hairs and others just touch the brush to the print and leave the deposit of ink by withdrawing the brush rather slowly.

Remember you lay the ink on and you hop it off. A quick touch and a quick withdrawal removes the ink.

Clean up and smooth out the print when it is built up to the density you desire with a clean brush by hopping or smudging.

Dry in a place free of dust. The best way is to hang the print up by clips, weighing the paper at bottom with two extra clips.

DE-FATTING

The inky look may be removed after the print is absolutely dry by submerging it for a few minutes in Gasoline, Naphtha, Carbon Tetra Chloride, or any similar solvents of grease. Carbon Tetra Chloride is rather energetic but has the advantage of being neither inflammable or explosive.

CLEANING THE BRUSHES

Any of the solvents named for de-fatting will clean the hairs of ink but I have found Carbon Tetra Chloride the best. It is safe and it evaporates in a few minutes. Dip the tips of the hairs into the liquid and gently squeeze out between the folds of clean muslin. Repeat until perfectly free of ink.

Once in a while use soap and water after the usual cleaning, manipulating as you would a shaving brush to produce lather. Rinse out very thoroughly and dry on a clean, lintless rag. Then hang up with the hairs down to thoroughly dry.

Never put a wet brush into its sheath.

WARNINGS

Demachy has wisely said "Bromoil is distinctly not an athletic pastime." He meant that every operation is to be performed lightly. Do not lay on gobs of ink or hop with a rap as if you were driving a nail into hardwood.

Patience and art, not force, achieve pictures in Bromoil.

BOOKS

The foregoing directions cover the ground in a skimming way that will serve many and be hopelessly inadequate for others. For the latter several excellent books exist.

Dr. Mayer's book on Bromoil, published by the American Photographic Publishing Company of Boston; and the Photo Miniatures, numbers 106 and 186, will be found invaluable. Articles in the British Journal of Photography during October, 1926; in various issues of Camera Craft during 1925 and 1926; and in the issues of September, October and November of American Photography, will be of further help.

SUMMARY

There is nothing difficult about Bromoil. It is feared only on account of its being unfamiliar. Once learned all that is left is to acquire the art of making pictures or utilize the faculty already possessed.

ODDS AND ENDS

1 or 2 drops of Ammonia to the ounce of soaking water increases the relief when great contrast or speed is needed.

Glycerine in the soak-water helps some papers to take the ink to let go of it.

Entire areas may be wiped out and local retouching done with a quill Camel's Hair brush wet with Javelle water or diluted Chlorax.



PORTRAIT BY J. ANTHONY BILL

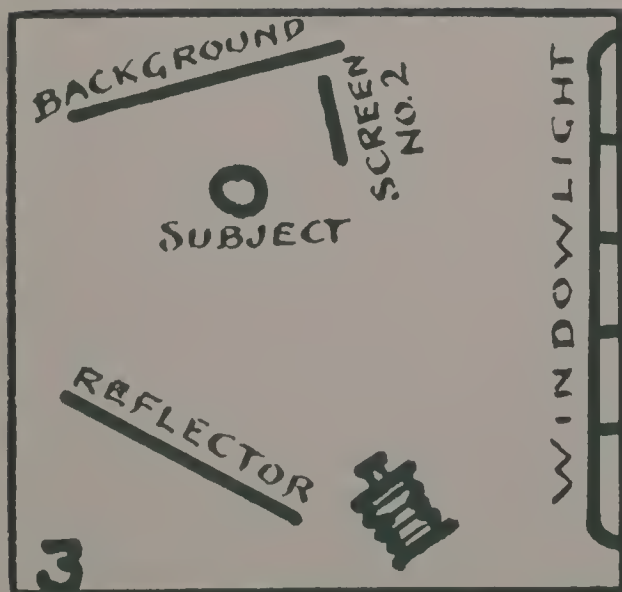
SUBJECT
13 FEET
from
SKYLIGHT

Ⓢ Q HEAD
SCREEN





PORTRAIT BY O. J. SMITH



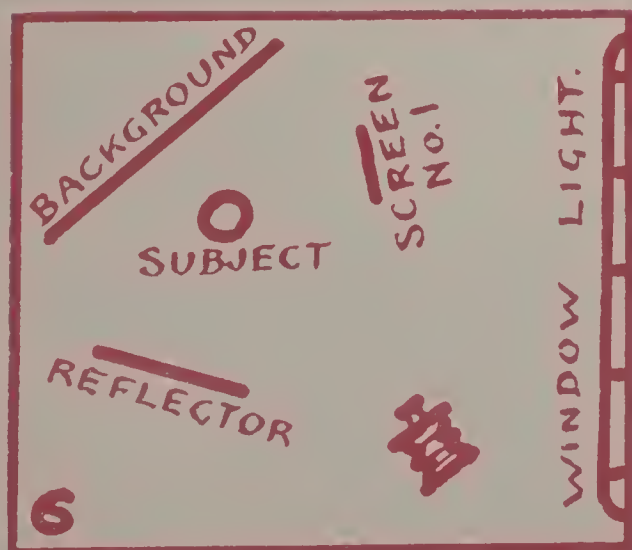
The straight window is of clear glass; lower portion closed to a height of $4\frac{1}{2}$ feet. This window is 12 feet wide by 9 feet high.

The opaque screen is brought forward sufficiently to shade ear.

Subject is 8 feet from light.



PORTRAIT BY O. J. SMITH



The lighted match effect is produced by the subject holding a 60-watt Mazda bulb between his hands, the direct light from which is carefully shielded from the lens by his fingers.



PORTRAIT BY J. ANTHONY BILL

TWIN
ARC
LAMP



AT HOME
PORTRAIT
By Arc Light

BROMOIL BLEACHES

A	Copper Sulphate.....	5 drachms
	Water.....	3 ½ ounces
B	Potassium Bromide.....	5 drachms
	Water.....	3 ½ ounces
C	Potassium Bichromate.....	Saturated Solution

To Use: Take 3 parts of "A" and "B" and 1 part of "C." Add 2 minims of Hydrochloric Acid to each 7 ounces of this solution and dilute with 3 or 4 volumes of water.

BROMOIL BLEACH

As Used by Louis A. Goetz

Copper Sulphate (10% solution).....	2 ounces
Chromic Acid (10% solution).....	1 ½ drachms
Potassium Bromide (10% solution).....	1 ½ ounces
Water.....	3 ½ ounces

BROMOIL BLEACH

Doctor Emil Mayers' Formula

Copper Sulphate.....	6 grams
Potassium Bichromate.....	1 gram
Potassium Bromide.....	6 grams
Hydrochloric Acid.....	1 c.c.
Water.....	210 c.c.

STAIN REMOVER

On hands—from ink or developer.

A	Potassium Permanganate.....	16 g.	or	½ ounce
	Sulphuric Acid C. P.....	5 cc.	or	75 minims.
	Water.....	1000 c.c.	or	32 ounces
B	Sodium Bisulphite	5 g.	or	1 drachm
	Water.....	100 c.c.	or	25 ounces

Use: Dip in "A"; rinse freely, then dip in "B" or any Acid Hypo.

On hands—from Nitrate Silver

A	Potassium Ferricyanide.....	40 g.	or	1 ounce
	Potassium Bromide.....	40 g.	or	1 ounce
	Water.....	1000 c.c.	or	24 ounces

And, after rinsing, dip in "B" as above, or Acid Hypo.

CARE OF THE HANDS

Anointing the fingers with lanoline before commencing work, and rubbing the grease well into the skin, will do much to avoid the need of after treatment.

RETOUCHING

A retouching frame may be made from pieces of soap and cracker boxes or the negative may be leaned against a glass tumbler with a sheet of white paper for reflector, but the manufacturers who make real retouching frames may be presumed to know what is best. A ready made device for the purposes costs from two to five dollars and may be folded up compact.

Pencils must be of the best, graded from the hardest HHHH to medium hard. Faber's Siberian Graphite, Hardmuth, Dixon and the American Pencil Company produce splendid pencils for retouching.

Sharpen pencils so that about an inch of the lead is cleaned off the wood and rub to a long needle point on OO Sandpaper, finishing off on brown wrapping paper and even polish on a bit of muslin. Maintain the condition of the point.

Brushes are indispensable and two or three Number 1 and 2 camel's hair or sable will be about right. Wet them between your lips and see that they come to a true point and stay that way. Brushes that spread or have a tendency to shape irregularly are worthless.

Wooden sticks are handy. Toothpicks of the sort that are pointed at one end and wedge-shaped at the other are best.

A stick of the finest India Ink, a jar of Spotting or Opaquing compound or a cake of Windsor and Newton's Indian Red should be part of the equipment.

The stroke. Too much is said of the stroke. Cross hatching, figure 8, ovals, letter S, zig-zag, right angles, each has its use. Make it your study to match the effect of the parts immediately surrounding the spot on which you work. Also try to discover which fits your hand best. The only object of retouching is to get the desired effect without the work showing in the final print. A really fine retoucher can work up a plate with pencil, dope, etching, and everything put on and taken off the emulsion that can be devised and produce a negative that will enlarge 8 diameters without showing the work.

Etching Knives: Individual tastes differ so on this head that many able retouchers and most inefficient ones make their own knives out of old razor blades, pen knives, barrel-hoops, and what not. You may buy good tools cheaply. Let your care be in keeping them clean, rust-free, and sharp.

Do not jump from place to place but do all the work in each part, then go over the whole to blend, tie together, and cleanup.

Do not touch high lights or the denser portions: That only means more building up on the other parts.

Do not put the eyes too close to the work. Look at what you are doing, not through it.

Do not work too steadily or intently, but rest the eyes frequently by looking at other things and longer distances, and mind and muscles relaxed. It is astounding how often the amateur retoucher, yes, and sometimes the professional, work into a constrained, tense, condition, which evinces itself in the work by stiffness and palpable doctoring.

Pinholes and clear spots should be well coated with the dope, varnish, medium or what you choose to call it. With the softer pencil, Say H, fill in by making dots until the density is brought up to the surrounding parts.

Wrinkles should be worked out by lines having a general direction parallel to the clear part to be covered. These lateral lines may be tied together with cross hatching or zig-zag.

The eyes are the most difficult task and unless retouching is imperative leave them alone. Personally I should in the most urgent case let someone else do it. Years of experience have perfected eye retouchers but no book can give the reader that experience.

Etching may be a matter of scraping or of abrading. If the knife be used, hold it almost at right angles or at such a slant that the surface shall be scraped, not cut. Rubbing with alcohol or a more effective abrading with Putz Pomade, Globe Polish, or the following composition will be found all that could be desired.

Flowing a Ground Glass Substitute or Varnish over the glass side or the non-emulsion side of a film will enable one to retouch on the backs of negatives. Ground or Matted Celluloid may be bought. Watch for scratches and clear spots and reject any not perfectly even in the matting. With a touch of glue in each of the four corners fasten a piece of this, cut to size, to the back of the negative with the Matt side out. Retouch on this.

Or buy some of the best grade architects' tracing paper or Papier Mineral and glue on as above. Retouching may be done on this. This wrinkle is especially advisable in practicing retouching, since the negative remains in its original condition and after proofing, the paper may be torn off, another substituted and new attempts be made.

RETOUCHING DOPES

I.

Alcohol.....	3 ounces
Camphor.....	½ ounce
Sandarac.....	½ ounce
Venice Turpentine.....	1/5 ounce
Oil Lavender.....	3/20 ounce

II.

Turpentine.....	2 ounces
Rosin.....	40 grains
Balsam Fir.....	½ drachm
Chloroform.....	30 drops

RETOUCHING ABRASIVE

Impalpable Carborundum Powder.....	2 parts
White Mineral Oil.....	6 parts
Alcohol.....	1 part
Rose Oil.....	1 part

The mixture when stirred should make a thick, treacle-like mass. If too thin add more powder. To use stir and take a very little on a rag pulled tight over the surface. Rub the spot to be reduced gently but briskly. If much surface is to be removed take a clean part of the rag and fresh abrasive now and again.

For small spots use a stomp or make one. The cork stomp of Crayon Artists is especially useful.

Finally: Study much, practice conscientiously, make occasional proofs—do not get discouraged.

Urgent and Important: Do not over-retouch. Know when to stop and stop.

DEXTRINE SYRUP

Yellow Dextrine 4 ounces, cold water $7\frac{1}{2}$ ounces, mixed to a smooth emulsion, then brought to a boil in a double boiler and stir continually. When completely dissolved add $1\frac{1}{2}$ drams formaldehyde. Keep in sealed jars for use in making Opaques and such pigments.

OPAQUE

Take any good grade of Mucilage or Photo Paste and mix enough lamp-black and Red Lead to make a stiff paste. Now add just enough Glycerine to keep it moist and to avoid mould stir in a few drops of formaldehyde. This is the approved formula but I have found a quicker drying compound advantageous. This is achieved by using half and half of water and alcohol instead of just water to obtain the needed consistency. The Photo Miniature gives this—and it works well: Mix dry, fine rouge 4 ounces, with 1 dram of lamp-black. Work into a paste with equal parts Alcohol and water $\frac{3}{4}$ ounces, add 3 ounces of the dextrine syrup (see above) and when completely smoothed add 10 drops Oil of Mirbane (Nitro-benzole). Keep well covered and sealed to prevent evaporation.

RE-TOUCHING DOPES

1. Take Venice Turpentine and thin it to desired consistency with water-white spirits of Turpentine.

2. Dissolve 1 dram of Rosin in 1 ounce of Turpentine and 1 ounce of Benzine. If too thick add more Benzine. If too thin add more Rosin. When of the proper consistency add ten drops Poppy Oil.

CELLULOID NEGATIVE VARNISH

Boil the gelatine from old films or film scraps. Take the cleaned celluloid and cut into small pieces which dissolve in Amyl Acetate. Put as much of the celluloid in as will dissolve in the course of two or three days, with occasional shaking. A thick syrupy liquid will result. Thin this to water consistency with the Amyl Acetate and strain. This makes a splendid varnish for plates if poured on and drained by one corner, quickly. The plate must be absolutely dry or a white bloom will result. It is also good for dipping prints which then become waterproof and virtually unscratchable. Furthermore it is the liquid known as Banana Oil or Gold Paint Medium used in mixing bronze paints.

SCRATCHES ON GLASS

Flowing a thin film of Canada Balsam over a warmed plate of glass will generally render scratches photographically invisible, or another clear glass plate cemented on with the Balsam will go further in obliterating the blemish.

THE DARK ROOM

The British are particular in having their dark-rooms literally dark and it is a common custom to load plate-holders and at least start development in absolute darkness. The Germans have investigated safe-lighting and commonly the dark-rooms of the continent are well illuminated by screened or what is known as indirect lighting filtered through chemically safe films mounted between glass. In America there is still much carelessness and many dark-rooms are to blame for fogged plates and papers: the blame being too often passed on to the manufacturer. This, notwithstanding that the Eastman Kodak Company have put lanterns, lamps, filters and so forth on the market which are really safe. The Wratten filters, the Agfa filters and some others may be accepted as perfectly suitable.

Colored glass in reds and yellows may be safe and may not, certainly green as marketed in the flashed plates is not safe unless made especially for photographic use. That more harm is not done is due to luck and the fact that instinct makes even indiscreet workers hide the sensitive materials from the direct light till they have been in the developer long enough to have become comparatively insensitive.

A good dark-room must be absolutely light-tight. If after staying in the chamber for five or ten minutes you can detect a glimmer of light entering through however minute a chink, decide to remedy that then and there.

Ventilation is not only a matter of health, which is of prime importance, but the chemical reactions are to be relied upon only when the air is not contaminated with gases from the material used, by-products of the human consumption of oxygen and exhalations of carbon dioxide. A free ingress and egress of air, too, helps to carry off vapors from volatile chemicals which in the rush of work even careful men too often leave uncorked on the table or shelf. Photo Miniature number 82, Dark Room Work (Tennant and Ward), and certain free literature issued by the Eastman Kodak Company, the Agfa Handbook, Wellington and Ward and in fact most of the makers of plates, films and papers, will give the reader minute information and designs which should clog up these pages.

Space should be ample to turn freely and give elbow room so that breakage and spilling be avoided and comfort be gained.

Cleanliness is, of course, imperative. Dust makes for pinholes in negatives at time of loading and before and during development. The bacteria in dust settles on boxes, finds its way into the covers, breeds on gelatine and the rapid deterioration is sure to follow.

Dryness is hardly possible where much water and solutions are used, but may be approximated to within safe bounds by proper drainage and the practice of emptying all trays and covering all tanks when not in use. In fact, the covering of solutions makes them keep and is one more aid in obtaining the perfect results which are aimed at.

Sweeping is best done with a hair floor brush which has been dipped in what is known as floor oil or the cheaper Golden Machinery Oil used for lubricating purposes on fine but large machines. Such oil with, say, one percent of Pine

or Cedarwood oil added gives a product that is sanitary, insecticidal, and agreeable. It makes a splendid polish for waxed floors and furniture if a further addition be made of floor wax in solution. Floor wax in the paste form dissolves readily in turpentine or Naptha and an ounce thus dissolved in two ounces of the solvent and added to a quart of the oil mixture given above will give as fine a polish as can be bought.

Work Tables, Cupboards, and Shelves—in fact all woodwork should be painted. Formerly black asphalt was specified. It has been found that the reflected light is no more actinic than its source and that white walls and woodwork are just as safe in a safe light and more comfortable than black. For such as still prefer black there is no better waterproof, acid-proof, but not alcohol, turpentine, or Naptha proof covering than Probus Black. For White any good flat white for a filler or better a filler of boiled linseed oil followed by a coat of flat white, a second coat of white lead in oil properly thinned with turpentine and some varnish for body, and a final coat of one of the modern cellulose enamels will be found to be “De Luxe” and durable. As this goes to press we are informed that a White Probus will soon be on the market. The sample given us for our severest tests was found all that it should be, though a trifle thick for ready brushing.

Sinks should be of wood, roomy, not too wide or deep, but as long as space permits. From front to back, 30 inches should be the maximum, and about 10 inches deep. If possible have all inside corners and edges finished with a quarter-round moulding concave, so that cleaning be easy and thorough. And be sure the joints are rabbited or otherwise so jointed that when set in white lead or plastic cement they be watertight even before painting. The preference seems to be for black sinks though my white finished one gives me a comfort and facility in working that was lacking when I worked in a black one. The length should be such as to allow of at least two taps and these should be at least two feet from either end and an equal distance from one another. If you can find room for three or even four taps so much the better. One of these taps should have a convenient length of tubing which being flexible, may be used to fill and rinse trays or submerge to provide a flow upward from the bottom of trays or tanks. If you have three taps have another shorter length of rubber tubing attached with a spray device to spray off negatives after fixing and before drying.

The height of the sink from the floor should be determined by the height at which the worker can proceed most comfortably. The tallness or shortness of the person interested and not the fixed rules of the carpenter should be the determining factor.

Drainboards at each end of the sink are of the greatest importance, though if the choice be imperative between drainboards and longer sinks, the longer sink is to be preferred. This drainboard should be grooved to drain inverted graduates, trays, etc., and should therefore slant slightly toward the sink. Speaking of slants it might be well to have the sinks themselves tilt slightly toward the back right or left corner where the outflow is. I warn the reader against an outlet placed in centers: Water collects in pools at the corners and must be wiped to the drain. Sinks have been made with screened or latticed

bottoms, but these are generally a nuisance. A smooth bottom is easiest kept clean and being of wood will be no more likely to cause breakage than the wooden screening.

A shelf at such a height as to clear the head when leaning over the sink, and yet handy to the reach on the wall back of the sink is invaluable for having the bottles, etc., continually in use and for putting a thing out of the way while working. If there be a window have it so recessed that no splashing will soil the pane and no bottles fall through it. An inch batten or some other device making a raised edge to this shelf will keep the things put upon it from sliding off or furnish you with the clue as to whether you have put the bottle or graduate on the shelf itself or partly in the air.

Graduates are safest kept inverted on pegs just long enough to clear the edge of the glass from the shelf by a quarter or half inch. This allows draining off the last drops and facilitates air drying. Pegs are convenient for funnels, but should be cone-shaped so that wedging and cracking through expansion be averted.

Should facilities be at hand, hot water is invaluable and this may be piped to the sink or a corner be set apart where a Bunsen burner and the proper support for a kettle be ready for need.

Lay nothing down that can be hung up, even for a moment. Have plenty of brass hooks conveniently placed which paint as you have the woodwork and on these hang paddles, and whatever. Stirring rods can be elegantly disposed of in a rack made of a narrow board bored with round holes a little larger than the diameter of the rods and another piece of wood of the same size to support the glass cylinders on end. This device can be made from the thin ends of a cracker box. It will be found, not a makeshift, but a real appurtenance, lending its influence to smooth and efficient working.

The arrangement of shelves, cupboards, sinks, loading tables, etc., should be studied out in advance. Go through the motions of the entire series of operations as you expect to perform them and plan to so place the fixtures as to save steps and produce access, and availability. I have seen a dark room where the worker unloaded his plates next to the sink and swore frequently at finding the empty plateholders splashed with water and hypo, and in one studio the unloading was done so far from the tanks that a dozen chances of accident were rendered possible and certainly a dozen steps that might have been saved were expended between one and the other.

If the floor is to be of plain boards, by all means paint it with a good floor paint. If you feel you can and are willing to afford a covering, use cork carpet and not patterned oil-cloth or linoleum prints. One of the best and cheapest dark-room floor-coverings is the heaviest sheet roofing to be obtained. The rolls come in various widths and weights. Choose that width which will avoid any seams or which will enable you to place the joints in places where they shall be least exposed—under shelves and tables, but not under or around the sink. This covering will be as waterproof and last as long as cork covering costing many times the money.

The entrance should be a double door arrangement so contrived that one can be opened only when the other is tightly shut. I have seen one so made by a

simple lever which was raised and released the opposite door after it was closed. A commoner method is to have a labyrinth or maze entrance, a simple arrangement with a door at each end of a passage that turns twice around a midway partition. You enter one door and turn to the right about two feet further than the door opening, then stepping around the partition mentioned you turn to the left an equal distance and find the second door. Even when both doors are left open the likelihood of light passing around the corners is small. Even this danger may be removed by hanging a heavy, dark drapery over the passage where the turn occurs. Paint the inside of both doors and the walls, floor and ceiling of this passage black to avoid light reflections.

These directions are general and are given as a hint. The best advice is to use your head more than any book. The amateur generally must content himself with what his home affords and his family permits. The professional will have his own ideas and proceed according to his better light anyway. This chapter is offered as a starting point.

EBONIZING

Sandpaper any semi-hard or hardwood. Brush over 10% solution Potassium Bichromate made with hot water and brushed on hot. Use sparingly. When dry apply saturated solution Gallic Acid. If not black enough repeat with both solutions.

For French Polish, oil. For Gloss, varnish and rub.

CLEANER FOR BRASS

Dissolve off the lacquer with alcohol and cleanse of all grease in strong lye-water, then apply the cleaner with a swab or mop and let it dry in, then polish off the powder with a soft rag.

Whiting.....	1 ounce
Water.....	5 ounces
Alcohol.....	1 ounce
Oxalic Acid.....	10 grains

Mix the whiting with half the water until it is well in suspension; do the same by dissolving the Oxalic Acid in the other half of the water: Mix in 8 ounce bottle and add the alcohol. To use, shake well and apply as directed. **Warning:** Do not get lye-water or any solution containing Oxalic Acid on the hands, especially if they be scratched.

BLACKENER—Brass and Copper

A	Copper Nitrate.....	200 grains
	Water.....	1 ounce
B	Silver Nitrate.....	200 grains
	Water.....	1 ounce

Mix and immerse the scrupulously cleaned brass. Remove, heat and polish with a little oil and soft rag.

BLACKENING BRASS

Water.....	20 ounces
Lead Acetate.....	1 ounce
Hypo.....	1 ounce

Boil and dip the brass until black. Rinse in cold water, polish and lacquer.

PHOTOGRAPHING SHINING METAL

Polished metal may be prepared by burning some of the usual Flashlight mixtures on an open tin plate. The fumes leave an even white bloom on everything. When this is worked properly it is superior to rubbing on putty or lead painting and it can be cleaned off much more easily.

SHELLAC—Water Solution

Borax.....	1 ounce
Water.....	16 ounces
Shellac.....	5 ounces

Boil the borax in the water; when boiling add the shellac and boil until dissolved. Filter after cool and settled. If water has evaporated thin with water to make 20 ounces.

FOR NEGATIVES

When fixed and washed while still wet put into a tray of the above and rock as for developing for 10 or 15 minutes. Wipe the glass side dry and put on rack to dry.

FOR PRINTS

Spray on with blow pipe atomizer or dip and drain.

CLEANER—Nickel Plating

Swab on:

Alcohol.....	98 parts
Sulphuric Acid.....	2 parts

After a few seconds wash off, then swab off with plain alcohol and polish with a soft cloth.

Brass

Water.....	1 ounce
Whiting.....	$\frac{1}{4}$ ounce
Oxalic Acid.....	10 grains

Dissolve the Oxalic Acid in the water. When dissolved add the whiting and mix to a smooth paste or shake until evenly suspended. Do not let this come in contact with the skin. When dried on the brass, rub off and polish with a soft rag.

Glass and Bottle

Water (hot).....	10 ounces
Potassium Bichromate.....	$\frac{1}{4}$ ounce

When cold add slowly:

Sulphuric Acid.....	$\frac{1}{2}$ ounce
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MEDICAMENTS

CAMPHENOL SULPHUR

For Barbers' Itch, Eczema, Metol Poisoning, Etc.

Lanoline (Lanum Dehydrated).....	1 ounce
Phenol Crystal.....	15 grains
Camphor.....	45 grains
Sulphur.....	3 drachms

Dissolve the camphor in 1 drachm alcohol, add the Phenol in a glass pestle, add the Lanum to this and when the mass has been made into a soft mixture add the sulphur a little at a time and work to a smooth homogeneous paste.

ICHTHYOL

Lanoline.....	1 ounce
Camphor.....	45 grains
Ichthyol.....	20 grains

STAINED FINGERS

Water.....	16 ounces
Sodium Sulphite.....	4 ounces
Sulphuric Acid.....	1 dram

Take half an ounce of this and add 4 ounces of water. With this in a bowl at hand you may dip your fingers into it occasionally, or when washing up use it freely with sand-soap, Sapolio, Bon Ami, or whatever. The Pyro stain vanishes like magic.

LIBRARY PASTE

White dextrin.....	2¾ pounds
Water 160 degrees F. (Important).....	2 quarts
Oil Wintergreen.....	0.8 cc.
Oil Cloves.....	0.8 cc.

Keep at 160 degrees till mass turns to a translucent jelly. Strain through muslin and bottle.

VEGETABLE GLUE—Very Fine

Picked Clear Senegal Gum.....	½ ounce
Dextrin (White).....	2¼ ounces
Spirit Camphor.....	4 drachms
Ammonia.....	4 drachms
Water.....	8 ounces

Pound gum with dextrin to a fine powder in mortar, then rub up to smooth paste with a little water at a time, then heat at 160 degrees for about ten minutes and when partly cooled put in a jar. Add the camphor and ammonia when pretty well cooled and just before putting in jar. DO NOT heat Ammonia and Camphor.

ETCHING ON GLASS

A	Sodium Fluoride.....	60 grams	60 grains
	Potassium Sulphate.....	12 grams	12 grains
	Water.....	500 ccs.	1 ounce
B	Zinc Chloride.....	14 grams	14 grains
	Hydrochloric Acid.....	65 ccs.	65 min.
	Water.....	500 ccs.	1 ounce

Mix in equal quantities just before use. For writing on glass use a quill. By dissolving gelatine and putting a proper amount of the above in the solution the glass may be coated on one side, allowed to set, when the surface will be found to mat in a few days.

GROUND GLASS SUBSTITUTE OR VARNISH

Dissolve	90 grains Gum Sandarac
	20 grains Gum Mastic
in	2 ounces Ether
then add	1 ounce Benzole

The Benzole may be decreased or increased to produce finer or coarser grain. The plate to be made into ground or matt finish must be cold.

INKS

LABEL INKS

Water.....	1 ounce
Pyro and Sulphate Iron.....	equal parts each q.s.

FOR GLASS, CHINA, ETC.

A	Water.....	5 ounces
	Borax.....	$\frac{1}{4}$ ounce

Boil together and when dissolved add:

B White Shellac $1\frac{1}{4}$ ounces and boil until shellac is dissolved. Cool and add aniline color to suit.

FOR PRINTS OR NEGATIVES

Bleaches out the silver and shows writing in white.

Write with ordinary pen.

Potassium Iodide.....	2 ounces
Iodine.....	90 grains
Gum Arabic.....	90 grains
Water.....	6 ounces

DRY MOUNTING ADHESIVE

Boil for 5 minutes 5 drams of Borax and 1 dram Sodium Carbonate in 7 ounces water, then add 2 ounces bleached or white shellac and continue boiling for about 5 minutes more. Keep surface skimmed free of scum. Let cool and bottle. This may be brushed on both sides of tough onion skin paper to make Dry Mounting Adhesive Tissue, or painted on the back of the print. To make it adhere apply a hot flat iron.

COPYING TO OVERCOME HALF-TONE SCREEN

Put a sheet of very pale blue glass about an inch in front of the print to be copied, taking care that it be on a perfect plate and make a reduced size negative. Enlarge to desired size from this. Focusing may be sharp.

WAXING SOLUTION FOR PRINTS

White Japan Dryer.....	4½ ounces
Turpentine.....	6 ounces
or	
Oil of Poppy.....	2 drams
Oil of Cloves.....	1 dram
Turpentine.....	10 ounces
Benzine.....	5 ounces
or	

10 parts of any good Floor Wax softened in a double boiler to which 2 parts Turpentine and 2 parts Japan Dryer are added.

Apply all of these with a soft, lintless rag and gently rub in. Do not use any of them too liberally. Just enough is plenty.

TRANSPARENTIZER—Papers

1. Vaseline on wrong side and rub in with a clean rag. Iron by putting a sheet of clean paper over and use a moderate hot iron.

2. Castor Oil.....	1 ounce
Alcohol.....	4 ounces

3. Equal parts of: Canada Balsam
Oil Turpentine

4. Common Coal Oil, well brushed on and allowed to permeate, will serve till it evaporates when it may be renewed.

5. Soak at 176°F. till saturated:	
Paraffine.....	4 parts
Linseed Oil.....	1 part

Dry at once between lintless blotters.

6. Soak overnight in:	
Castor Oil.....	8 parts
Canada Balsam.....	1 part

Drain, gently wipe with lintless rag, hang up to dry where there is no dust.

7. Terebenthine.....	14 grains
Light Rosin.....	40 grains
Gum Dammar.....	40 grains
Camphor.....	3 grains
Paraffine.....	14 grains

Use water bath. Beware of fire.

PAPER NEGATIVES

Any of the above will render thin papers sufficiently translucent to serve as negatives.

DECKLE OR FEATHER-EDGE PRINTS AND MOUNTS

Sandpaper, files, and rasps have their drawbacks and the use of a saw wastes paper. If abrasive paper be preferred to the wrinkle given below the best for the purpose is Number 2, E Garnet paper.

For the best method to provide yourself with a Carborundum Tile or Terrazo Stone Number 16, H. Put the mount or print on a tough piece of cardboard and both on a strip of wood—any old cardboard and any old bit of wood will do, so long as they have true, straight edges. Jog print or mount and these supports to an even edge and rasp with the stone. If a coarse deckle is desired use the coarser side of the stone, if a hand-made paper effect is wanted use the finer side.

This will enable you to buy your cut cards of the desired size and to have them deckled on lower end, top and bottom, or all four sides. You may even find it a pleasing novelty to feather-edge your prints. If so, work with the print face down and rasp it from the back.

GRADUATED BORDERS

Substitute ground glass celluloid for the opaque paper and glue on mask to make the white margin. Put in the opaque center and glue down. You now will have a mask that will give two tones of gray with a clear center in which to print the portrait by second exposure.

HINT

Make the opening in the mask which you use to expose the portrait a trifle larger than the opaque center so that the printing laps over. This will assure a freedom from white lines due to slight faults in register.

NOTE

The directions are complicated when read but by proceeding step by step you will find it works out easily.

VIGNETTING

To avoid pasting on cut-outs or cotton batting, block out a glass side of negative with any reliable opaque and soften edges of the paint to desired outlines. This permits use of the printing machines on which the negative is placed face up or down.

MASKS FOR DOUBLE PRINTING

These are best cut by putting two sheets of opaque paper together and cutting the opening through both. The cut out rectangles are carefully kept and an exactly equal strip cut off top and side to leave the needed opening. The opening in one of the two masks is now enlarged by accurately cutting the same strip out of the opening on the four sides. Adjust carefully and trim together. Put into a printing frame registering against top and left side. Apply glue and press a sheet of glass down on it. The center square may now be glued down to make the desired border effect. The smaller mask may be used for double printing the portrait.

Ready-made masks may be bought of any photo dealer which offer a number of designs, but fancy borders are bad taste, as a rule.

THE COMMERCIAL PHOTOGRAPHER

It is not in the province of this work to enter into the innumerable devices, many of them invented as needed, used in the production of Commercial pictures. What has been said of dark-rooms, etc., applies here, but cameras, lenses, equipment in general must fit the particular class of work determined upon. The cameras will, naturally, be of the portable sort with every adjustment, and the lenses of greater variety, long and short focus, wide angle and so forth.

The workrooms will be larger and means of copying, reducing, enlarging, storing merchandise, mounting machinery, shading objects from reflections, shelving at visual angles, and what not, must be provided.

The work will have to be done with more speed than in a portrait establishment and so the working tools will be designed for speed. The printing frames and printing machines will be made for quick action. The enterprising photographer who enters this sort of work must be awake to what is being offered by the manufacturers. Time is money to a Commercial Photographer. His overhead must be assimilated by efficiency and up-to-date machinery, if we may call it that.

In such an establishment Inventory is a real need. Financial disaster has come to many a Commercial Photographer through waste in the stock room.

He must strive for volume and quick turnover in order that his necessarily large plant may work to capacity and that he may buy in quantity.

As his business grows by publicity and that publicity comes from being oftenest in the public eye with his output, he must have many customers and means of exploiting his prints.

But, above all, a reputation for good work and fair dealing is the greatest asset.

CUTTING-MACHINE LIGHT

An ideal arrangement is to have the cutting table open and covered with a sheet of very heavy plate glass, preferably frosted on the under side with ground-glass varnish or a thin white paint. The top light shows the outlines of the prints and lights properly disposed under the glass of the table will throw the shadow of the straight edge of the cutter up through the print so that accurate margins may be cut.

SPEED OF PLATES AND FILMS

There is, of course, an inherent ratio of speed in sensitive material, but to all intents and purposes, in these days of latitude of emulsions, speed is that inherent value, plus light-value of subject, plus temperature and nature of developer. As for instance:

Standard Orthonon. Bluish gray day, given aperture remaining the same, exposure the same:

Developer Metol..... 68° F. fully exposed

Hydroquinon..... 70° F. rather contrasty

Hydroquinon..... 60° F. underexposed

Nor will the rule of sufficient time in the developer compensate. Denser plates disguise the defects in that papers are chosen to fit the negative.

The useful deduction is to standardize your developer for the general purpose to which you apply photography and expose according to the developer you use.

Copying calls for contrast.

Commercial work demands clearness and detail, but snappy withal.

Pictorial should be rather thin, soft and with minute care as to values.

For each consider the exposure as the first step, the results of which shall not only govern but be governed by the nature and temperature of your developer.

Let me reiterate: Standardize.

Experiment to your hearts content as a pastime or for instruction but when you settle down to work find yourself equipped to know what the purpose of each exposure shall be, what the developer is going to be to further that purpose and what the ultimate print is for: Then expose accordingly. Your light-guage, exposure-meter, and what-not may be a valuable assistant, but your own brains must be the master.

COPYING METHODS—Exposure

In Photo Miniature Number 196 (Tennant and Ward), the following is as complete and concise as can be wished:

Avoidance of Grain

The texture of the paper, abrasions, etc., are exaggerated by top or side lights. The best means of avoiding all grain is to illuminate from both sides with Cooper-Hewitt tubes of a length equal to that of the copying board or easel. Next in efficiency are the long tubular Mazdas placed top and both sides. These should be about as far from the plane of the copied article as the diagonal of its dimensions, and all lights must, of course, be shaded on the side facing the lens.

HALATION

This phenomena is variously attributed to reflection from the back of the plate and to irradiation within the emulsion itself. It is probably due to both—to the former for the most part and somewhat to the latter. It evinces itself when strong light is photographed against a relatively less actinic surrounding.

Manufacturers make what they call Non-halation or Anti-halo plates with backs thereof coated sometimes with a soluble composition like caramel, pigment, or red dye suspended in gum and sometimes by pasting on a sheet of non-actinic, non-reflecting paper which dissolves off in the developer. Lumiere first conceived of coating the sensitive emulsion over a substratum of red gelatine which is discharged in a bisulphite or hydro-sulphite solution after fixing. Lately matted or ground glass backs and matted or ground glass substratum have been utilized on both glass and films.

By these means the worst halation is avoided, but the blocking up of highlights and detail goes on. Daylight windows show no sashlines and the curtains hung against the light lose their pattern.

Halation can be remedied in such slighter cases in the development by using clear-working hydroxide developers. I worked out a Glycine-hydroxide developer which differs from the Hubl formula in its proportions and seemed to work better over a variety of plates, films and bromide papers, but it was received with such a salvo of enthusiastic praise and heated condemnation that I have reprinted it elsewhere in this book for what it may be worth to the individual. It virtually eliminated the inter-radial halo for me in over 80 per cent of my experiments.

A mechanical means, very simple and effective, is to rub down the affected part with a clean, soft rag dipped in Alcohol. Just draw such a bit of muslin over the index finger, wet it with Ethyl or Methyl Alcohol which is known to have no water in it, and gently but briskly rub the density down until detail is visible and the printing value is equal to the remaining surface of the negative.

The abrasive I devised and which is given elsewhere in this book will be found to work infinitely quicker and more effectively. It leaves the plate cleaner than metal polishes, emery-powders, and such things, and requires no cleaning-up except a gentle wiping off with another part of the same rag.

COPYING

ON PROCESS FILMS OR PLATES

Expose F16—5 times—Barre screen.

9 minutes. Use tank developer.

Same—No screen. U. S. 32 F —2 minutes.

ON COMMERCIAL ORTHO FILMS OR PLATES

Same but expose $\frac{1}{4}$ as long.

PORTRAIT FILM OR PLATES

Same but expose $\frac{1}{6}$ as long.

TO OVERCOME HALF-TONE SCREEN

Put a sheet of very pale blue glass about an inch in front of the print to be copied, taking care that it be on a perfect plate and make a reduced size negative. Enlarge to desired size from this. Focusing may be sharp.

An old fashioned way was to stop down to f32 and while copying the half-tone print gently to tap the easel on which it was pinned. The slight vibration kills the screen.

COPYING WITH SCREENS OR RAY FILTERS

When copying violet on white ground use Panchromatic plate and Green (B) Tri-color Wratten filter.

Blue Prints, Panchromatic plate and "A" or "F" Wratten Yellow Paper or age stain, Panchromatic plate and "G" or contrast filter.

Potassium and Sodium Salts may be used interchangeably and be accepted as of equal strength.

COPYING STAINED PRINTS

Lay a screen of the color of the stain over the print or look through the filter. If the stain is invisible or almost so, that is the proper screen or filter. Use Panchromatic Plate or Film.



PORTRAIT BY J. ANTHONY BILL



SKYLIGHT
WIDE OPEN
3000 WATT
FLOODLIGHT
AND SPOT

(S)

SUBJECT
8 FEET
FROM LIGHT





PORTRAIT BY J. ANTHONY BILL

Sc

(S)

SUBJECT
10 FEET FROM
WIDE OPEN
SKYLIGHT



PANCHROMATIC PHOTOGRAPHY

Eastman Kodak Company, Cramer Plate Company, Wratten and Wainwright, Agfa Company, Wellington and Ward issue free books on Ray Filters and their use. These may be had for the asking and cover the subject.

The Eastman Kodak Company sell for a nominal sum a Test Chart consisting of a series of color filters mounted on a card with data printed thereon.

OVEREXPOSURE

If negative flashes up take it out quickly and put it into clear water; add one or two drops Citrate Potassium to each ounce of developer and put plate back to complete development.

By this method plates may be purposely over-exposed and better negatives result than by usual exposures.

EXPOSURE MEASUREMENTS

Let me strongly recommend the American Photography Exposure Tables and advise that they be studied conscientiously.

EXPOSURES

A "Ray Filter" is recommended for all subjects in groups "A" and "B".

Shady banks, ravines, glades and under trees in full foliage require from 4 to 24 times more exposure than group "C."

Exposures for larger or smaller stops can be easily calculated from this table by keeping in mind the rule by which all stops are marked—each succeeding smaller stop requires twice the exposure of the one before it. Example: If 1 second is the correct exposure for stop 8, 2 seconds would be required for No. 16, four seconds for No. 32, etc. The same rule applies when using larger stops, but the exposure is then made one-half of the succeeding smaller stop.

These exposures are averages so calculated that the table will be a good guide on sunny days in winter as on days of summer sunshine. When the day is hazy about twice the exposure should be given. This is easily done by using the table below the one in which the subject is listed.

When using Box Cameras and other Fixed Focus, Single Lens Cameras of the folding type that do not have the stop markings shown in these tables, the exposure should be:

Group A. Make Snap Shots through the next smaller stop than the one used for ordinary Snap Shot work.

Groups B and C. A Snap Shot with the stop ordinarily used.

Group D. Very satisfactory Snap Shots can be made with the Box Cameras on cloudy days with the subject under the open sky. Landscapes can easily be made, providing the clouds are not too heavy. Most satisfactory pictures of groups and near objects are made with the camera rested on a tripod or some other firm support and an exposure of $\frac{1}{2}$ to 1 second given.

FRILLING

Frilling may be avoided by rubbing a cake of Paraffine along the edge of the plates before developing, taking care that the wax covers the point at which the emulsion and the glass end. It seals the joint and prevents the solutions from getting under.

AIR BRUSH

COLORS

Alizarin-scarlet, Rose-madder, Antwerp-blue, French Ultramarine, Prussian Blue, Burnt Sienna, Raw Sienna, Bistre, Vandyke Brown, are permanent and transparent.

Vermillion, Hookers' Green, Chrome Lemon, Mauve, Crimson Lake, Sky Blue, Raw Umber, Venetian Red, are useful.

Snow-White, Reproduction White, Silver White, are opaque and free from lead, thus assuring that they will not blacken under the action of light and air.

FIXING

Gum Water is both a serviceable fixer and scumbler. It ties the dots together and smoothes the whole. Make a solution thin enough to flow freely and spray without clogging or blobbing.

DYES

Aniline dyes of the Diamond or Rainbow Household Dye sort, or in quantities from the American Dye Corporation, Metz and Company or Hoechst, will make wonderful and lasting colors for air-brush work.

To dissolve dyes take the required quantity of the dry powder and in a china cup mix it to a consistent paste with a little cold water. When there are no lumps left and all is moist and smooth add enough boiling water to make a concentrated solution. To this add about 5 minims Acetic Acid, and one drop Oil of Cloves to each liquid ounce and keep in brown bottles. To use dilute to required tint.

These colors may be mixed save in a few rare cases in which the chemical combination spoils both ingredients.

CRAYON EFFECTS

The finest grade of lamp-black mixed to a paste and then thinned with more water will dry on the print like crayon but, also, if not protected by glass will rub like crayon or charcoal.

CLEANING THE AIR BRUSH

Clean your apparatus after each use by blowing clean water through it, followed by a little denatured alcohol. A prominent worker does the final cleaning with perfume which not only contains the necessary alcohol but serves to render the studio fragrant as a spring garden. Any perfume suits the machine but your nose and the noses of your customers should be considered. Use good perfume. It might be well also to keep all parts dry and clear.

FITTING A STUDIO

By the term Studio we shall mean, here and hereafter, the entire establishment which is to be devoted to the conduct of a business for taking and making portraits. This shall include the reception room, the gallery or operating room, and the dark-rooms, etc.

The Reception Room should in every way convey to the visitor what class of trade is desired. A fifty-dollar-a-dozen reception room might frighten away a fifteen-dollar-a-dozen clientele, and a fifteen-dollar room discourage the high-price trade.

Back of the hope to obtain high prices must lie the ability to deliver the quality of product, and what is more likely to be overlooked, an education and deportment which shall conform to the standards of the people most likely to have the money to spend and the willingness to spend it on superior and artistic pictures.

We shall not enter into furnishings here. That matter lies in the province of interior decorators, and furniture shops.

The Gallery or Operating Room, whatever the price to be charged, must be roomy enough to allow the camera to be moved from ten to fifteen feet from the subject and we dare affirm a free space of thirty feet is not too much.

In these times when overhead, flood, spot, and every other sort of artificial light may be had on short notice, it may seem superfluous to speak of side-lights and skylights, but the ambitious and conscientious worker will be glad to have these available in his coming years of practice.

The manner of obtaining an education in artificial lighting is not from books. Literature in plenty and of a sort that is minute and clear can be gotten from the manufacturers, also the travelling salesmen are qualified to act as personal instructors and are more than ready to be such to prospective buyers. Inform yourself on as many contrivances as you can and reserve your decision until you have compared them in your own mind and cleared up any doubts that arise in thinking over what you have been told.

The day of the ornate background is past. The most eminent portraitists have the fewest props. A plain gray, a plain white, a clouded or mottled, and a framework on which may be stretched or hung any rug, drape or length of felt is plenty of accessories of this kind.

An infinite variety of patterns may be projected from in back of the background itself or from one side of the subject between the sitter and the background by use of a spotlight and intervening branches, leaves, head-screens, and so forth. The angle at which the shadows from them is projected determining the sense of motion and the composition. Wonderfully beautiful effects may be gotten in this way.

The Camera should be a substantial, thoroughly reliable sort. To expect respect and confidence from a patron when he is made to face a dilapidated, insignificant box with a scratched lens mount and a tiny objective is a vain expectation. The first impression is made in the reception room but the psychology of preconceived satisfaction is created by the manner and the tools of the operator.

The Lens, if only one, should be a high grade anastigmat working at least at f4.5 and preferably at f3. With such an objective diffusion may be gotten with any of the supplementary devices now on the market. Diffusion disks are absolutely effective and practical. When two or more lenses can be afforded one should add one that can take full lengths and groups without moving into the next room to get inclusion. And, let us say, one of the ultra rapid diffusion type for special purposes.

The preference for large plates remains with many leading photographers but not a few of the great standardize in five by seven and enlarge to sizes as ordered.

There is some loss in using small plates. Unless the operator can visualize in advance what he is going to get by projection he had better work on eight by ten negatives. The beauty of projected enlargements is, however, a great gain and gives freedom in subsequent working.

The Dark-Room should be airy, safe, accessible and roomy. Work with as much safe-light as the material allows and be assured that plenty of space will pay in the saving from spoilage and loss of time.

Study the order of things. Plan to step from one operation to the other with a minimum of exertion and time. Lay out the places for everything but do not make such placing unchangeable. Experience will suggest improvement as time goes on.

The Sink is an important thing. Have it built of wood, have all joints rabbited, set in lead, and screwed (not nailed) together. Give the first coat of boiled oil and let it dry. Coat with two or three coverings of asphalt varnish or with some of the photographic paints made especially for the purpose. Probus is a preparation that covers over half the sink tanks and wooden trays in America. In England an acid-proof covering is on the market at a small cost.

Have plenty of taps. By carrying one horizontal feed-pipe almost the entire length of the sink it may be tapped every two or three feet. Tilt the sink very slightly toward the drain and have the vent generously large. A division that makes two sinks of the one is an advantage.

Put no shelves at a height or projecting so far forward that it is possible to bump your head on their edges in leaning over the sinks. Have plenty of shelves and paint them with waterproof paints so that they may be kept immaculately clean and free from wet or dry rot.

If you work in large sizes and have floor tanks or stock solutions in five-gallon carboys, have floor trays built and waterproofed and have these deep enough to hold the entire contents should breakage occur. A far look ahead, but one that has many times paid high dividends.

Do not use the dark-room for a store-room.

Put your loading table at the extreme other end of the dark-room from the sinks and chemicals. Over this table have hung, conveniently and so you may find them in the half-light, a broad camel's hair duster for plates and plate-holders. Use this brush before loading and when unloading.

If possible have a good sized ventilating arrangement over the sink and in addition ventilating registers near the floor and ceiling.

If possible have your dry chemicals stored behind locker doors.

Your Mounting Room should be light, airy, and also roomy. The table is best made of redwood covered with floor oil-cloth or linoleum. It had better be about thirty or forty feet wide and six to eight feet long, with shelves handy for paste bottles, brushes, etc. Under this table may be shallow drawers to hold mounting papers, mounts, and tissue.

Do not permit the mounting table to be used for packing up finished orders. Have a wrapping table in the same room but on the other side of the room. Over this have twine supplied from a hanging receptacle, and at the end of the table a roll of paper in the most used width. If the photographer is really fastidious he will cut (not tear) from the roll, or will use cut sheets instead of rolls.

The package as it reaches the customer is part of the influence on his sense of satisfaction. Some of the highest-priced concerns wrap in expensive imported papers, others deliver in card-board folio envelopes, and some in boxes as beautifully designed as those in which confectionery comes.

Do not buy odds and ends. A bargain hunter is always extravagant in the end and generally may be found floundering among a lot of useless things gotten simply because of cheapness. Buy nothing you do not need, and then buy the best.

Quantity buying is economical only when consumption is large. The cash discount on small lots paid for on delivery, added to the freedom from spoilage and deterioration and the leaving of odds and ends more than equals the price margin on large purchases. But if you use much material you should be able to make enough in the turnover to pay for it and can then add quantity price-saving to the rest.

Keep your stock in perfect order, keep careful inventory, and by all that is important, keep everything immaculately clean. Carelessness, lack of knowledge of what you have or have not and should get, and dirt, are almost as big a drain as that part of your overhead called "Front."

If you expect to establish a well-paying clientele mix with people who are inclined to buy liberally. Go where money is, be liberal to help, create a liberal atmosphere. Become one of the best people.

A book could be written on any one of the subjects broadly treated here and such books have been written. You can get them for nothing from the manufacturers or dealers. Take stock of the foregoing and decide whether it has helped you to choose, then proceed.

PORTRAITS AGAINST WINDOWS

When it is desired to make a portrait of a person sitting at a window and the scene outside is to show, block out the light with white sheeting outside the window, of as many thicknesses as shall properly subdue the daylight, illuminate the subject and expose almost but not quite full. Now remove the sheeting but have the subject maintain the same position and give a brief exposure of the window with out-doors showing through. Develop in soft developer or tank. If necessary proceed as for halation.

AN OUTLINE OF THE SCIENCE OF PORTRAIT LIGHTING

By O. J. Smith

I am frequently requested to suggest a list of practical equipment for making portrait lighting. Light of sufficient volume and brilliancy to produce gradation is the first requirement. A lens of liberal focal length to avoid distortion and preferably of the portrait series.

A reflector to round out the shadows and the very important and much neglected light controllers such as a head screen of black India linen and a side curtain, two or two and one-half feet wide, of opaque material to round back the light side, is about all that is required for the purpose of modeling and balancing the lighting.

If daylight is used, a clear glass window with north exposure and sufficient height to direct the light downward at an angle of about forty-five degrees, and of sufficient width to produce front, side and back illumination is ideal.

Light is directed by closing out the lower portion of the window with opaque curtains or shades, running from bottom to top and placing the subject near enough to the source of light to direct the shadow from the nose at above angle. Equally important is the volume and angle of front light. If the shadow cheek is not relieved with a touch of light to build up its true form, we are assured that more front light is needed, as flatness either in lights, halftones or shadows in portraiture is the first indication of faulty manipulation and indifferent quality. Turn the sitter, facing the light sufficiently to relieve the shadow cheek of its former flat and uninteresting appearance. This procedure will also, no doubt, relieve the eyes of their former dull and lifeless appearance, by introducing catch lights above and to the side of pupils from which the light is directed. If at this stage it is found that the catch lights do not appear, their absence is no doubt due either to protruding eyebrows or deep-set eyes, and it becomes necessary to lower the shades on window until the desired result is obtained. It will be noted that the direction of shadows, the illumination of shadow cheek and the catch lights in eyes, have furnished the key in directing the angle of side and front light. It must be understood, however, that this cannot be a permanent arrangement.

Features vary considerably and must be dealt with accordingly; however, general principles remain unchanged and the above is an excellent guide in directing the light and enabling one to make each action count. It is a pitiful loss of time and energy to strive unguidedly for effect. We now have the foundation of a good portrait lighting. The light, too broad and flat is properly directed and the shadows well placed, are dense and lack gradation. It remains to introduce intermediate tones, to blend between highest lights in true relative values, though to the deepest shadows. In other words, to point up the lights and shorten the shadows, thus introducing roundness, texture and tone values. We are dealing with what is known as plain portrait lighting, which no doubt deserves credit for more pleasing portraits, true to likeness and character, than all other lightings combined.

When properly made they display an air of refinement which please the most critical, and I would advise the beginner to master plain lighting before at-

tempting the more eccentric. At this point, a brief analysis of the characteristics of subject and materials at our disposal may not come amiss. The human face has length, breadth and depth. The ears of an adult are located five to seven inches farther back than the forehead, nose, lips and chin, the cheeks of course rounding back to the ears. The head and figure is a mass of continuous curves to be portrayed in relative values (length, breadth, and depth) on a flat surface, with light and shadows. It is the natural tendency for highlights to stand forward on a flat surface, while halftones and shadows recede in proportion to their density. If the ear on the light side receives as much light as the forehead, nose, lips and chin, that particular ear will step forward with due haughtiness, on the same plane, and since it does not belong there, it will claim first attention. The cheek on the light side will appear too broad and flat, while if the background is in proper relation, the shadowed ear will repose where it belongs. A bald head sometimes becomes a flat elongated forehead, much too high and out of all proportion to the face, due to neglect of the proper shading. The head screen manipulated from the rear, directly between the light and top of the head and brought forward to a position where it casts a subdued shadow over the prominent surface, without disturbing the brilliant light on the point of forehead nearest the lens, will correct the difficulty. The same method is applied when dealing with white or very light hair.

If the light is weak or subdued or if the screen is too far from subject it will not be effective. Brilliancy or intensity of light controls the distance from subject to screen, which is as a rule eighteen to twenty-four inches. Having determined the proper direction of light and assuming that we are making a three-quarter view of the face we will proceed with the following objects in view:

The points of forehead, nose, lips and chin nearest the lens should receive the strongest highlights. Halftones should grade from lights back and over the ear (not too abruptly) but just enough to render the face in true roundness and proportion.

The light cheek, since it is nearest the lens, should receive a stronger light than the shadow cheek, but not as strong as the highest light on the forehead. The narrow opaque screen is placed parallel with the side window just back of the subject about twenty-four to thirty inches away and brought forward directly between window and subject, sufficiently to subdue light on the ear. This shading will blend forward over the cheek, and care must be exercised to avoid flattening the high-lights or reversing the strongest light to the shadow cheek. Check up the highlights carefully while manipulating and stop the screen at the point where highlights are in proper relation to one another. The shadow side will now appear more luminous, but in reality it is not. If too dark, do not place the reflector broadside or parallel with shadow ear, but place it parallel with window, in front of subject on shadow side, then turn it diagonally from window toward subject, thus illuminating the shadow from the nose and gradually blending back to the deepest shadow, which should occupy a position at the outline of the shadow side of the face. Stand at a distance sufficient to get a general view of the face and portion of figure being portrayed. If the light is stronger at lower portion than about the shoulders, place the black India linen head screen low, quite near and directly between the light

and subject and gradually raise the screen sufficiently to subdue the right or lower portion, allowing direct light to fall upon the face and shoulder only. Touches of high-lights are concentrated to points of face and shoulder nearest lens, halftones grading back with densities proportionate to distance or depth, there is no distortion of modeling and a true likeness in the chosen position and available expression is the final result. Sufficient exposure to register detail through to the deepest shadows is essential, then forget the shadows and develop just far enough to separate the high-lights from their surrounding background of halftone. A well-balanced and modulated lighting, exposed and developed normally, will require little or no modeling at the hands of the retoucher. Spotting and slight blending between halftones and shadows should be sufficient. The style of bold, broad lighting as above described is very becoming to elderly people, with strong character and fully developed features, of well-proportioned outline. Thin faces or hollow cheeks may be rounded out to an appreciable extent by modelling more delicately. This is accomplished by placing the light controlling screens farther from the subject, thus using the lights more open. Arc lamps and cabinets containing powerful blue Mazda lamps are, in reality, miniature skylights, the light radiating from a direct point or comparatively small area, and they require the use of auxiliary lamps if the best results are to be obtained. The light must be extended as would be the case with a daylight window which is too small to supply the necessary front, side and occasional back light. Front light supplies general illumination, which tends to flatness, while light directed from the side or slightly from the back of subject produces the necessary brilliancy and contrast. It is readily noted that such requirements cannot be obtained with artificial light radiating from one source only. One or more five hundred to one thousand watt blue Mazda lamps suspended from ceiling, forty-five degree angle in front of subject nine feet from floor and well diffused, will supply the front illumination and simplify the task of proper distribution. A small flood or a spot light may be utilized for the purpose of back lighting, which is very effective in touching up the composition with brilliant highlights, well concentrated. Artificial light is handled identically to daylight except that it does not contain the same penetrating power, and it is necessary to place the subject nearer to the source of artificial light to obtain comparative brilliancy. A view from the shadow side is oft-times very pleasing, especially if the features are round and regular. The light cabinet is raised to proper height, the subject is placed almost directly opposite the middle of illuminated screen covering arc or lamps so that one half of the illuminated screen is extending back of the subject and approximately five to six feet away. The shoulders may be turned towards the light and the face turned slightly more to the camera, which occupies a position forward and almost parallel with lighting cabinet. The same general rules apply in directing the shadows as formerly described. At this stage the light is broad and flat and the shadows lack the intermediate tones so essential to roundness and true proportion. Turn on the ceiling lamp which should be as above described (well diffused), and place the India linen head screen quite near and to the forward edge of illuminated screen covering. Move it slowly toward background, directly between light and subject, to a point where direct

front light is subdued sufficiently to relieve highlights resulting from the predominating directness of light from farther end of cabinet back of subject. Highlights will appear more pronounced as this head screen is moved nearer to subject. Gradation on waist and shoulders results from raising the opaque curtain upward between light and subject, closing out the lower direct light and blending through halftones to lower edge of picture, resulting in the concentration of direct light to the face, shoulders and upper portion of the figure. Following the exposure the above lighting may be altered to various pleasing results by adjusting the head screen to a position more directly between subject and the light, subduing all direct light to the point of delicate modeling then introducing brilliant touches of light by means of the spot or small flood light, manipulated as taste or fancy dictates. As a rule the spot light is used at rather sharp angles from the back, on either side of the subject and at times it is projected from the top of the background directly back of the sitter. Again it is used for concentrating light to the shadow side of brunette or auburn hair. Portrait films are capable of separating an extremely long scale of gradation. Gradation with contrast and brilliancy may be introduced in the lighting and reproduced in the negative with such material, while emulsions of a shorter scale would require lightings of flatter character and less gradation.

In all these examples I have striven to use only such as may be duplicated in any studio and even in the home. The screens and reflectors are essential items of equipment. Where they are not on hand makeshifts may be improvised but really good work can be done only with proper tools.

MAKING PORTRAITS

By J. Anthony Bill

When that important mass, the general public, is pleased with some photographs, it wants to know "how they were done."

To describe my methods ought to be very easy; but the production of a corrent photographic "atmosphere" and the supplying material surroundings that will put the subject at his ease, whereby he is physically and spiritually at his best, really is a hard matter.

The ideal studio, in the first place, should be a peaceful habitation. It should be so restful that the person being photographed will relax without being urged to.

When a camera portrait is commented on by other people and they say "What a natural picture," it is proof that the pictured person was "natural." Naturalness was permeating not only the environment, but the subject's personality and individuality as well.

To get the desired results in this matter of relaxation, mental and physical, I find, as most successful photographers have found, that gently arousing the subject's real interest—whether it be in clothes, golf, motoring, mountain climbing or music, books, theater, or movies, is the easiest and quite the best way to achieve satisfactory results.

Individuality will show always, in the interested work of the operator. If I have no interests in my subject's interests; if I cannot assume, for the time

being at least, such an interest, then I am no artist, and deserve no honors! The simpler, less "stage-set" your camera-portraits appear, the longer they deserve to and will, live. Stilted or "stiff," detail-overburdened portraits never show the quality of photographic personality. People looking at your work will not say then to themselves, "When I have a picture, I'll come here." What personality the subject possessed has been smothered, one might say, in poorly thoughtout environment and that before mentioned atmosphere.

In photography, we ought to have an ideal. The man or woman of whom you are making a portrait surely has an ideal; perhaps many of them.

But in your case remember, that for the moment, at least, your ideal is to produce on the sensitive plate a concrete, artistic and complete picture of the sitter's individual personality. If that can be secured by certain surroundings, your studio should have those surroundings. If the sitter is self-conscious because of having a picture made, it is up to you to get that sitter started thinking and talking along the lines of least spiritual resistance—which is always what interests him.

And when you have successfully helped him to relax, both mentally and physically, you are going to make a good portrait. Possibly a better one than you have ever made before. And when you have done that you will be thinking of making photographs that are better than the best you have seen. Never keep in mind portraits made by operators who are not as good as you. Think up, not down! Aim high and keep yourself on tip-toe to equal and surpass the best you have seen.

But to get down to the "brass tacks" for the profession.

In the first place, let us begin with children. They are really the most important portion of the photographer's audience. They are both the potential and the actual patrons of the photographic art as we are carrying it on.

The child of today, the youth of tomorrow, the adult of day after tomorrow! A satisfactory photograph of a child, therefore, leaves the desired pleasing impression upon the parent. Later on that impression naturally will be transmitted to the subject of the picture and by him or her to others.

The psychology of childhood is and should always be, a most interesting and important attribute for the photographer to study carefully.

Unless you gain the confidence of the child, portraits cannot be either artistically or professionally successful. The photographer who establishes a comradeship between the child and himself approaches it in a practical, philosophical manner which will work artistic wonders.

When you have a child at ease, you have won half the battle; for a natural mood is essential. You have won its confidence by actually being, for the time, its playmate, not an austere, order-giving stranger whose pet phrase seems to be "Look at my finger now, and smile, and watch for the birdie to come out of this box!" Grown people know how very difficult it is to smile naturally to order; and young people are quite as prone to sense that difficulty.

In one sentence, taking child portraits can best be accomplished by making the child forget the curious looking box on three legs and filling the child-heart and the atmosphere of the room with the play-mate spirit.

In photographing women I would emphasize the fact (for it is a fact) that they are most emphatically grown-up children. They want you to make them look, in their photograph, as they would like to look. They naturally pay more attention to the costume; and I have had many women ask me to photograph the best side of their faces. Of course we of the profession know that there is a best side and we quite naturally make that side more prominent in full or three-quarter views of the faces, as well as in picturing profiles.

There are various styles of portraits, of course. I have been most successful and naturally most interested in camera portraits that are perfected by paying much attention to delicate light effects and that ease of mind which pictures itself in and through the physiognomy.

Such effects are usually delightful to the women because of the extreme artistry employed.

Pictures of this sort, both of women and of children, should be kept in a key of soft tones, plenty of air, of light, and of color. Beautify them all you can in pose, in light and simplicity of surrounding. In the case of women you can never overstress their femininity, so don't think that their "fussiness" about arrangement of gown, or hat or anything else that is intimately connected with them, is to be placed among the non-essentials. Here is a most important thing to be considered, not overlooked.

In making portraits of men, experience shows that they are very much less concerned about looking well, or about the surroundings that are to be used in the pictures, than they are about "getting it over with."

To most of them, having a picture made is just a plain bore. The quicker it's done the better they'll be pleased.

Having such a feeling makes it difficult for the conscientious operator. The camera can produce a truly good and characteristic portrait. Right here must come the psychology of the sitter at his spiritual ease. You can't talk toys or games or tell him stories as you may have done when the subject was a little chap. You can't discuss changes in fashion or So-and-So's wedding, as with your women patrons. But you can get close to your men by discovering and harping upon his hobby.

Whatever he is interested in, be it golf or going into the woods, baseball, or biological study; fruit raising or fishing, he will respond to well-placed little inquiries about that pet hobby of his. As he relaxes mentally and physically you will note that his eyes, those "windows of the soul" brighten perceptibly. They may have been wandering or dreamy before, showing that he was really still at his desk though he had brought his body to you to have it photographed. But now you have him in proper mood for real portrait-making.

If I have been successful in camera portraiture it is largely due to my mental attitude, too. I want to do even better work than I have done. Long ago my photographic wagon was hitched to a star and the harness still holds. What I have done is only an indication of the bigger and better things I hope to do. Ambition is not monopolized by young people. We oldsters have quite as much right to it, especially the ambition to improve on what we have done in the past.

And if the portraits of our men-patrons are strong, faithful in delineation and

full of character, when we sit in front of the camera, and not stand behind it, our own character will show its best side on the plate!

PORTRAIT SUGGESTIONS

To make subject appear tall put head nearer top of plate.

To make short place head further from top of plate.

Face being narrow light from below and put camera low, pointing upward.

Face broad light from above and put camera high, pointing slightly downward.

Blue eyes—throw a faint pinkish light into eyes.

Use long focus lens to get roundness and atmosphere.

Backgrounds should be unobtrusive and diffused—they are not the portrait.

No matter how soft and diffused you choose to make the features remember that the eyes must be clean cut and clear to appear lifelike.

Light your subject evenly, flat, to begin, then build up your high light with flood and spot lights and finally place the proper screens to make the whole hold together.

Old people are best shown in a low key.

Children call for a high key—plenty of light and no massed shadows.

The catch-light in the eyes should be carefully considered and should show in both eyes in such a way that strabismus is not suggested.

Watch for a moment when the subject relaxes the mouth muscles, then take. The hardening of the corners of the mouth has caused many a re-take.

Re-touching calls for great care, much taste and immeasurable judgment. If the subject favors a marble smooth face give a rather full exposure and light soft. If the subject wants the lines God put upon each face as a mark of favor—or the reverse—light accordingly and give a shorter exposure.

A Portrait Artist should be a student of character.

The crudest amateur can snap a shutter. The professional should be able to make a "Likeness."

A "Likeness" is not a record of eyes, nose, mouth, features, but an everlasting picture of the face and the soul that animates it.

Do not accent infirmities or blemishes, yet do not so palpably disguise them as to more than ever attract attention to them.

Converse with the subject but, as you value your reputation, do not indulge in patter.

To photographers being equal in skill, education, refinement, culture, will mark one above the other, and his work will be by that much the better.

The negative should be clean. The re-toucher cannot perform miracles.

Do not rush your printer. Speed is at the cost of quality. Too fast a light cuts out some of the half-tones and blocks up the shadows.

Develop negatives and prints in filtered solutions and keep the fixing bath fresh and clean.

LENSES—Focal Length

Focus your lens on a very distant object until it shows sharp, then on a ruler until it shows sharp and measures accurately life size; the distance which you have moved the lens gives the focal length, sufficiently accurately to serve your purpose.

APERTURE

The "f" system is based on the ratio of the focal length to the aperture or diaphragm opening. A ready way of understanding this is to consider the "f" as the figure one and put it as the numerator of a fraction, the denominator of which shall be the figure or figures given as the stop number, as, for instance, "f4" is to be read as $f/4$, or $\frac{1}{4}$, meaning the diameter of the opening is $\frac{1}{4}$ of the focal length. Thus "5.6" would mean $f/5.6$, or $1/5.6$ of the focal length. Let us take a lens of 7-inch focal length and consider an aperture of f5: The diameter of the aperture should be $f/5$ or $1/5$ of 7 inches or $1\frac{2}{5}$ inches. On an ultra-aperture lens working at f2. and of 7-inch focal length the opening would have the relatively enormous diameter of $\frac{1}{2}$ of 7 inches, or $3\frac{1}{2}$ inches.

In buying a lens you may thus arrive at a knowledge of the size of what you are going to get and decide whether your camera can accommodate a mount somewhat near the size of a brass cuspidor.

CHOICE OF A LENS

For pictorial work one should have a high grade anastigmat, a diffused focus, and a single meniscus.

For commercial work a battery of lenses are essential, covering needle sharp process lenses for copying, anastigmats for architectural work, ultra-aperture for moving objects, diffused focus for pictorial and illustrative work, and quartz lenses for scientific work. For Portraiture the best portrait lenses and at least two, of long and short focal lengths, and one anastigmat, are essential. Men have built homes with an axe and a hammer but the best houses are built with a full kit of tools.

CARE OF A LENS

The essential thing in cleaning a lens is to remove the soiling without injuring the polish. A slight scratch does more harm than a dozen bubbles.

Dust the glass with a camel's hair brush, wipe gently with a soft, well-washed bit of linen and again dust with the brush to remove lint.

Use no acids or alcohol. If necessary to act more radically take to an optician.

THE AMATEUR PHOTOGRAPHER

He who works purely for the love of the art can do no better than to equip himself with the best. His dark-room should be as carefully designed and his things as well selected as the professional's. The dark-room is pretty much the same whether for portrait, commercial, or amateur use, but the cameras, lens and outfit in general differ greatly.

A five by seven view box or hand camera with a high grade anastigmat of f4.5 and 8-inch focal length, a Graflex or other reflecting type camera with a still faster lens if means permit, and the attachments that allow using film packs, roll-films, plates in magazines, one or all of these.

The amateur, too, will be likely to stock with all sorts of chemicals and plates and papers—he will do that—so it might be well to warn him that there are no bargains in perishable goods: And photographic papers, plates and films are perishable. Buy the best, buy it fresh, and do not stock up in quantities that will stay on your shelf for a year or more. You will find it far cheaper to buy as you need. A gross of paper is not cheaper than a dozen lot, proportionately, if at the end of a period of time you must throw half of the gross away as spoiled.

LIGHTNING OR FIRE WORKS

Place camera on tripod or firm support; set shutter for "time" exposure and open shutter with camera pointed at the object to be photographed. If lightning, point camera toward the part of sky where flashes are most frequent. When flash has occurred within the angle of lens, shutter should be closed, although no harm can come by leaving shutter open for several flashes, as each flash of light will leave its own record on the film. Use Stop F. 11, U. S. 8.

MOONLIGHT EFFECTS

Best subjects are those made across water in which the sun is reflected and are most successful in early morning or late evening, about half an hour before sunset or after sunrise. Make snapshot with the camera pointed directly against the sun while it is shining through the clouds or with its rays illuminating the edges of some heavy dark cloud. Make prints from the resulting negative very dark. The effects are very pleasing and the simplicity of it will be surprising.

FLASH LIGHTS

Pictures of little children are best made with Flashlight, especially during the winter months when the weather will not permit of out-door work. The flashlight powder is prepared in small cartridges or in sheets suitable for the average room and are simple and safe in any hands.

Leave all lights burning in the room, thus eliminating eye-strain, so objectionable in most flashlight pictures. Follow directions as given on each box or package. Set shutter for "time." Open shutter, ignite flash powder, then close shutter. Use Stop F. 11, U. S. 8.

CAMP-FIRE SCENES

Wrap the powder contained in one of the cartridges in some tissue paper, set the camera as before, and with the group properly arranged around the fire, throw this paper containing the powder into fire. To prevent the light reflecting back into the lens, place one of the figures between the flash and the camera.

PHOTOGRAPHING AT NIGHT

Buildings covered with lights.....	Stop F. 16—5 to 10 minutes
Store Fronts,Shop Windows, well lighted.....	Stop F. 16—10 minutes
Poorly lighted scenes and buildings.....	Stop F. 16—30 minutes
Open street scenes.....	Stop F. 16—30 minutes
Wet pavements or snow-covered scenes.....	Stop F. 16—15 minutes
Gardens, well lighted.....	Stop F. 16—15 minutes
Harbors.....	Stop F. 16—15 minutes
Moonlight pictures (made by the light of the moon).....	Stop F. 8, U. S. 4—One hour
Use ½ this time if full moon and ground is covered with snow.	

PHOTOGRAPHIC INTERIORS

	Bright	Hazy	Cloudy
White walls and more than one window.....	4 s.	10 s.	40 s.
White walls and one window.....	6 s.	15 s.	60 s.
Medium colored walls and more than one window..	8 s.	20 s.	80 s.
Medium colored walls and one window.....	12 s.	30 s.	120 s.
Dark walls and more than one window.....	20 s.	40 s.	2 min. 40 s.
Dark walls and one window.....	40 s.	80 s.	5 min. 20 s.

This table is calculated for rooms whose windows receive the unobstructed light from the sky, and for exposures made not earlier than three hours after sunrise or later than three hours before sunset.

INTERIOR PORTRAITS

Subject 3 or 4 feet from window, average room. No sun on subject.

	Bright	Hazy	Cloudy	In Sun Parlor
Stop F. 4.5.....	1/5 s.	½ s.	1 s.	1/10 s.
Stop F. 6.3.....	½ s.	1 s.	2 s.	1/5 s.
Stop F. 8—U. S. 4.....	1 s.	2 s.	4 s.	½ s.
Stop F. 11—U. S. 8.....	2 s.	4 s.	8 s.	1 s.

Double this time for rooms facing north or rooms not facing the sun.

Home portraits can be made with the ordinary Kodak or Brownie by using the Kodak Portrait Attachment over the regular lens. Subjects can then be placed about 3½ feet from Kodak. The price is 50 cents in all sizes. A beautiful illustrated booklet, "At Home With the Kodak," contains many helpful hints on portraits at home and is free for the asking.

INTERIORS BY ARTIFICIAL LIGHT

Accurate exposures cannot be given owing to the great variety of illuminants used, ranging from Oil Lamps to the very actinic Nitrogen Lamps now so generally used. The exposures here given are for the average Mazda Electric and Welsbach Gas Lamps, and will serve as a practical guide for other illuminants.

Average room, well lighted.....Stop F. 8—20 minutes
Medium or dark walls.....Stop F. 8—45 minutes to one hour

Approximately four to eight times these exposures required with the average oil lamps.

DEVELOPMENT IN GENERAL

With every package of plates, films, or papers you buy is packed a direction sheet. The formulas on these are the best for each brand. The makers are interested in your getting the best possible results. They have chemists in their employ whose life work it is to help you get the best results. No formulas are quite as good as those given by the manufacturers and these are not interchangeable for equally good results.

It may be well to tell the reader how this comes about. When the maker of a paper, let us say, has perfected a sensitive emulsion and carefully noted the very best developer for it he makes all future sensitive emulsions not by the same measurements and weights in its compounding but to conform to that developer. In other words a developer is not made to fit each batch of paper but all runs are made to conform to the standard developer. What hope can you or I have of bettering that developer?

Workers do not, however, always want standard results. There are idiosyncrasies in methods and tastes. The shade, the density, the contrast of certain developers please some better than other shades, densities, etc. Some prefer to find a developer that will work well with every brand of paper (for instance) they use, and shirk mixing and storing a number of developers.

Remember that Sulphite prevents yellowing of the image in Pyro developers, is a preservative from oxidization in all developers, and in too large a proportion produces fog.

Carbonate increases contrast up to a certain point and then causes fog or stain.

Bromide prevents fog up to a certain point, then degrades the color to a disagreeable or rusty green, and still further causes fog.

The stronger the developer the denser the negative in the ordinary way of development. In this way it seems to give greater contrasts.

Dilution really causes softness not only mechanically but in a way chemically as slow development gives a finer deposit.

Developers are quite as much a determining factor in the speed of a plate, film or paper as the speed put into the emulsion. A negative normally exposed for Metol will be twenty or more times underexposed for Hydroquinon. Notwithstanding the learned treatises to the contrary the above truth permits of compensating for errors in exposure (when known) by use of certain developers.

Tray development is strictly an amateur proceeding and the trouble is more than compensated for by the fun of seeing what happens. In expert hands it gives special effects for particular purposes that cannot be gotten otherwise.

Tank development is not only less trouble, time-saving, and productive of negatives with a finer grain through slow development, but it averages enormously in favor of getting workable results from over or underexposures, different brands and so forth. Professionals can no longer afford to do individual development.

Pyro is still the favorite of masters, professional and amateur.

Metol-Hydroquinon, called M. Q., is the universal favorite of the masses. Both are good.

The hair-splitting contingent who add a few grains of Adurol, or prefer the infinite variety of Organic developers on the market for one purpose or another will generally be found to have an equally large variety of negatives to print from, each presenting a new problem as to time and development.

Standardize as much as possible but do not become hide-bound and close to special means of obtaining particular results.

Learn to work with given material, perfect yourself in the use of these and your years will be more productive, your expenditures smaller, and your waste less.

All the things on the market were made to sell but you need only buy what serves your purpose. This does not mean you are not to advance with the progress of the times. It does mean that if you intend to do serious work you cannot play with everything that comes along.

Water is a chemical. See that you use only such as might be called C. P.

Mix carefully, measure and weigh accurately, keep utensils chemically clean.

METRIC SYSTEM OF WEIGHTS AND MEASURES

Measures of Length

Denominations and Values		Equivalents in Use
Myriameter.....	10,000 meters	6.2137 miles
Kilometer.....	1,000 meters	.62137, miles or 3,280 ft. 10 in.
Hectometer.....	100 meters	328. feet and 1 inch
Dekameter.....	10 meters	393.7 inches
Meter.....	1 meter	39.37 inches
Decimeter.....	1-10th of a meter	3.937 inches
Centimeter.....	1-100th of a meter	.3937 inch
Millimeter.....	1-1000th of a meter	.0394 inch

Measures of Surface

Denominations and Values		Equivalents in Use
Hectare.....	10,000 square meters	2.471 acres
Are.....	100 square meters	119.6 square yards
Centare.....	1 square meter	1,550. square inches

UNITED STATES WEIGHTS AND MEASURES

VOLUME—LIQUID

4 gills = 1 pint.	Gills	Pints	Gallon	Cub. In.
2 pints = 1 quart.	32	= 8	= 1	= 231
4 quarts = 1 gallon.				

FLUID

Gallon	Pints	Ounces	Drachms	Minims	Cubic Centimetres.
1	= 8	= 128	= 1,024	= 61,440	= 3,785.435
	1	= 16	= 128	= 7,680	= 473.179
		1	= 8	= 480	= 29.574
			1	= 60	= 3.697

16 ounces, or 1 pint, is sometimes called a fluid pound.

TROY WEIGHT

Pound	Ounces	Pennyweights	Grains	Grams
1	= 12	= 240	= 5,760	= 373.24
	1	= 20	= 480	= 31.10
		1	= 24	= 1.56

APOTHECARIES' WEIGHT

lb.				gr.	
Pounds	Ounces	Drachms	Scruples	Grains	Grams
1	= 12	= 96	= 288	= 5,760	= 373.24
	1	= 8	= 24	= 480	= 31.10
		1	= 3	= 60	= 3.89
			1	= 20	= 1.30
				1	= .06

The pound, ounce, and grain are the same as in Troy weight.

AVOIRDUPOIS WEIGHT

Pound	Ounces	Drachms	Grains (Troy)	Grams
1	= 16	= 256	= 7,000	= 453.60
	1	= 16	= 437.5	= 28.35
		1	= 27.34	= 1.77

ENGLISH WEIGHTS AND MEASURE

APOTHECARIES' WEIGHT

20 Grains	= 1 Scruple	= 20 Grains
3 Scruples	= 1 Drachm	= 60 Grains
8 Drachms	= 1 Ounce	= 480 Grains
12 Ounces	= 1 Pound	= 5760 Grains

FLUID MEASURE

60 Minims	= 1 Fluid Drachm
8 Drachms	= 1 Fluid Ounce
20 Ounces	= 1 Pint
8 Pints	= 1 Gallon

The above weights are usually adopted in formulas.

All Chemicals are usually sold by

AVOIRDUPOIS WEIGHT

27 $\frac{1}{2}$ Grains	= 1 Drachm	= 27 $\frac{1}{2}$ Grains
16 Drachms	= 1 Ounce	= 437 $\frac{1}{2}$ Grains
16 Ounces	= 1 Pound	= 7000 Grains

Precious Metals are usually sold by

TROY WEIGHT

24 Grains	= 1 Pennyweight	= 24 Grains
20 Pennyweights	= 1 Ounce	= 480 Grains
12 Ounces	= 1 Pound	= 5760 Grains

NOTE—An ounce of metallic silver contains 480 grains, but an ounce of nitrate of silver contains only 437 $\frac{1}{2}$ grains.

UNITED STATES FLUID MEASURE

Gal.	Pints	Ounces	Drachms	Mins.	Cub. In.	Grains.	Cub. C. M.
1	= 8	= 128	= 1,024	= 61,440	= 231.	= 58,328.886	= 3,785.44
	1	= 16	= 128	= 7,680	= 28.875	= 7,291.1107	= 473.18
		1	= 8	= 480	= 1.8047	= 455.6944	= 29.57
			1	= 60	= 0.2256	= 56.9618	= 3.70

IMPERIAL BRITISH FLUID MEASURE

Gal.	Pints	Ounces	Drachms	Mins.	Cub. In.	Grains	Cub. C. M.
1	= 8	= 160	= 1,280	= 76,800	= 277.27384	= 70,000	= 4,543.732
	1	= 20	= 160	= 9,600	= 34.65923	= 8,750	= 567.966
		1	= 8	= 480	= 1.73296	= 437.5	= 28.398
			1	= 60	= 0.21662	= 54.69	= 3,550

METRIC FLUID MEASURES

The cubic centimeter, usually represented by "C.c.," is the unit of the metric measurement for liquids. It contains 17 minims of water. The weight of this quantity of water is 1 gram. The following table will prove to be sufficiently accurate for photographic purposes:

THE CONVERSION OF FRENCH (METRIC) INTO ENGLISH MEASURE

1 cubic centimeter	=	17 minims.
2 cubic centimeters	=	34 minims.
3 cubic centimeters	=	51 minims.
4 cubic centimeters	=	68 minims or 1 dram 8 minims.
5 cubic centimeters	=	85 minims or 1 dram 25 minims.
6 cubic centimeters	=	101 minims or 1 dram 41 minims.
7 cubic centimeters	=	118 minims or 1 dram 58 minims.
8 cubic centimeters	=	135 minims or 2 drams 15 minims.
9 cubic centimeters	=	152 minims or 2 drams 32 minims.
10 cubic centimeters	=	169 minims or 2 drams 49 minims.
20 cubic centimeters	=	338 minims or 5 drams 38 minims.
30 cubic centimeters	=	507 minims or 1 ounce 0 dram 27 minims.

40 cubic centimeters	=	676 minims	or 1 ounce	3 drams	16 minims.
50 cubic centimeters	=	845 minims	or 1 ounce	6 drams	5 minims.
60 cubic centimeters	=	1014 minims	or 2 ounces	0 drams	54 minims.
70 cubic centimeters	=	1183 minims	or 2 ounces	3 drams	43 minims.
80 cubic centimeters	=	1352 minims	or 2 ounces	6 drams	32 minims.
90 cubic centimeters	=	1521 minims	or 3 ounces	1 dram	21 minims.
100 cubic centimeters	=	1690 minims	or 3 ounces	4 drams	10 minims.
1000 cubic centimeters	=	1 liter	= 34 fluid ounces nearly,	or 2⅛ pints.	

Measures of Volume

Denominations and Values			Equivalents in Use	
Names	No. of Liters	Cubic Measures	Dry Measure	Wine Measure
Kiloliter or stere	1,000	1 cubic meter	1.308 cubic yards	264.17 gallons
Hectoliter.....	100	1-10th cubic meter	2 bu. and 3.35 pecks	26.417 gallons
Dekaliter.....	10	10 cubic decimeters	9.08 quarts	2.6417 gallons
Liter.....	1	1 cubic decimeter	.908 quart	1.0567 quarts
Deciliter.....	1-10	1-10th cubic decimeter	6.1023 cubic inches	.845 gill
Centiliter.....	1-100	10 cubic centimeters	.6102 cubic inch	.338 fluid oz.
Milliliter.....	1-1000	1 cubic centimeter	.061 cubic inch	.27 fl. drm.

Weights

Denominations and Values			Equivalents in Use
Names	Number of Grams	Weight of Volume of Water at its Maximum Density	Avoirdupois Weight
Millier or Tonneau.....	1,000,000	1 cubic meter	2204.6 pounds
Quintal.....	100,000	1 hectoliter	220.46 pounds
Myriagram.....	10,000	10 liters	22.046 pounds
Kilogram or Kilo.....	1,000	1 liter	2.2046 pounds
Hectogram.....	100	1 deciliter	3.5274 ounces
Dekagram.....	10	10 cubic centimeters	.3527 ounce
Gram.....	1	1 cubic centimeter	15.432 grains
Decigram.....	1-10	1-10th of a cubic centimeter	1.5432 grain
Centigram.....	1-100	10 cubic millimeters	.1543 grain
Milligram.....	1-1000	1 cubic millimeter	.0154 grain

For measuring surfaces, the square dekamcter is used under the term ARE; the hectare, or 100 ares, is equal to about 2½ acres. The unit of capacity is the cubic decimeter or LITER, and the series of measures is formed in the same way as in the case of the table of lengths. The cubic meter is the unit of measure for solid bodies, and is termed STERE. The unit of weight is the GRAM, which is the weight of one cubic centimeter of pure water weighed in a vacuum at the temperature of 4 deg. Cent. or 39.2 deg. Fahr., which is about its temperature of maximum density. In practice, the term cubic centimeter, abbreviated c.c., is generally used instead of millimeter and cubic meter instead of kiloliter.

The meter is a measure of length equal to 39.370 English or American inches, a standard of linear measure supposed to be the ten-millionth part of the distance from the equator to the north pole, as ascertained by actual measurement of an arc of the meridian.

This system, formed on the meter as the unit of length, has four other leading units, all connected with and dependent upon this. Hence, we have:

1. The meter, which is the unit of measures of length.
2. The are, which is the unit of surface, and is the square of the meter.
3. The liter, which is the unit of measures of capacity, and is the cube of a tenth part of the meter.
4. The stere, which is the unit of measures of solidity, having the capacity of a cubic meter.
5. The gram, which is the unit of measures of weight, and is the weight of that quantity of distilled water at its maximum density, fills the cube of a hundredth part of the meter.

Each unit has its decimal multiples and sub-multiples, that is, weights and measures ten times larger, or ten times smaller, than the principal units. The prefixes denoting multiples are derived from the Greek, and are: Dekka, ten; hecto, hundred; kilo, thousand; and myria, ten thousand. Those denoting sub-multiples are taken from the Latin, and are: Deci, ten; centi, hundred (as in centigram or centimeter); and milli, thousand.

The metric system has been adopted by many nations, the English excepted. In America its use has been made optional, but is legalized by Congress. All photographic formulas received from the continent of Europe express values and quantities with metrical weights and measures. To utilize them directly without translating into the expressions of the English system, the student is advised to procure gram weights and cubic centimeter graduates, and substitute them for those denoting quantities according to the old plan.

THE CONVERSION OF FRENCH (METRIC) INTO ENGLISH WEIGHT

The following table, which contains no error greater than one-tenth of a grain, will suffice for most practical purposes:

1 gram	=	15 $\frac{3}{4}$ grains.	
2 grams	=	30 $\frac{1}{2}$ grains.	
3 grams	=	46 $\frac{1}{2}$ grains.	
4 grams	=	61 $\frac{1}{4}$ grains or	1 dram 1 $\frac{1}{4}$ grain.
5 grams	=	77 $\frac{1}{2}$ grains or	1 dram 17 $\frac{1}{2}$ grains.
6 grams	=	92 $\frac{3}{4}$ grains or	1 dram 32 $\frac{3}{4}$ grains.
7 grams	=	108 grains or	1 dram 48 grains.
8 grams	=	123 $\frac{3}{4}$ grains or	2 drams 3 $\frac{3}{4}$ grains.
9 grams	=	138 $\frac{1}{2}$ grains or	2 drams 18 $\frac{1}{2}$ grains.
10 grams	=	154 $\frac{3}{4}$ grains or	2 drams 34 $\frac{3}{4}$ grains.
11 grams	=	169 $\frac{1}{2}$ grains or	2 drams 49 $\frac{1}{2}$ grains.
12 grams	=	185 $\frac{1}{2}$ grains or	3 drams 5 $\frac{1}{2}$ grains.
13 grams	=	200 $\frac{3}{4}$ grains or	3 drams 20 $\frac{3}{4}$ grains.
14 grams	=	216 grains or	3 drams 36 grains.

15 grams =	231½ grains or	3 drams 51½ grains.
16 grams =	247 grains or	4 drams 7 grains.
17 grams =	262½ grains or	4 drams 22½ grains.
18 grams =	277½ grains or	4 drams 37½ grains.
19 grams =	293½ grains or	4 drams 53½ grains.
20 grams =	308¾ grains or	5 drams 8¾ grains.
30 grams =	463 grains or	7 drams 43 grains.
40 grams =	617½ grains or	10 drams 17½ grains.
50 grams =	771¾ grains or	12 drams 51¾ grains.
60 grams =	926 grains or	15 drams 26 grains.
70 grams =	1080½ grains or	18 drams 0½ grains.
80 grams =	1234¾ grains or	20 drams 34¾ grains.
90 grams =	1389 grains or	23 drams 9 grains.
100 grams =	1543½ grains or	25 drams 43½ grains.
1000 grams =	1 kilogram =	32 oz., 1 dr., 12¾ gr.

THE CONVERSION OF METRIC INTO AMERICAN MEASURE

The following table is computed true to the nearest half grain or minim, as the case may be, so it will prove a sufficiently near approximation to the required metric equivalents.

U. S. P. STANDARD

Gram, or c.cm.	Grains	Minims	Gram, or c.cm.	Grains	Minims	
1	15½	16¼	15	231½	244	The “kilo” or kilogram, the 1,000 gram weight, is equal to 32 ounces 72¼ grains “Troy or Apothecaries” weight, or 2 pounds 3 ounces 119¼ grains Avoirdupois. The “liter” or 1,000 cubic centimeters, or bulk of water that weighs 1 kilo, is equal to 2 pints 1 fluid ounce and 415¾ minims, U. S. P. Standard, or our glass graduates as commonly sold by reliable houses.
2	31	32½	16	247	260	
3	46	49	17	262	276	
4	62	65	18	278	292½	
5	77	81	19	293	309	
6	93	97½	20	308½	325	
7	108	114	30	463	487½	
8	123½	130	40	617	650	
9	139	146	50	771½	813	
10	154	162½	60	926	975½	
11	170	179	70	1,080	1,138	
12	185	194	80	1,234½	1,300½	
13	201	211	90	1,389	1,463	
14	216	227½	100	1,543	1,625½	
.....	.....	.....	1,000	15,432½	16,256½
.....	.....	.....	.....	1 kilo.	liter.

The grains and minims are easily reduced to fluid drachms and fluid ounces, or drachms and ounces Troy, by my readers, if they will only remember that 60 grains or minims go to the solid or fluid drachm, and 480 grains or minims, or 8 drachms solid or fluid, go to each U. S. P. ounce, solid or fluid.

Thus the table gives the value of 90 grams as 1,389 grains, of 90 cubic centimeters as 1,463 minims. How many ounces in each?

Dividing 1,389 by 60 for drachms, we have 23 drachms 9 grains. As 8 drachms go to the ounce, there are 2 ounces in the 23 drachms and 7 drachms over, so we have—in 1,389 grains there are 2 ounces 7 drachms 9 grains. In the same way we find 3 fluid ounces and 23 minims over, to be the value of 90 cubic centimeters or 1,463 minims.

TABLE SHOWING THE COMPARISON OF THE READINGS OF THERMOMETERS

Celsius, or Centigrade (C). Réaumur (R). Fahrenheit (F).					
C —30	R —24.0	F —22.0	C 23	R 18.4	F 73.4
—25	—20.0	—13.0	24	19.2	75.2
—20	—16.0	— 4.0	25	20.0	77.0
—15	—12.0	+ 5.0	26	20.8	78.8
—10	— 8.0	14.0	27	21.6	80.6
— 5	— 4.0	23.0	28	22.4	82.4
— 4	— 3.2	24.8	29	23.2	84.2
— 3	— 2.4	26.6	30	24.0	86.0
— 2	— 1.6	28.4	31	24.8	87.8
— 1	— 0.8	30.2	32	25.6	89.6
Freezing point of water.			33	26.4	91.4
			34	27.2	93.2
0	0.0	32.0	35	28.0	95.0
1	0.8	33.8	36	28.8	96.8
2	1.6	35.6	37	29.6	98.6
3	2.4	37.4	38	30.4	100.4
4	3.2	39.2	39	31.2	102.2
5	4.0	41.0	40	32.0	104.0
6	4.8	42.8	41	32.8	105.8
7	5.6	44.6	42	33.6	107.6
8	6.4	46.4	43	34.4	109.4
9	7.2	48.2	44	35.2	111.2
10	8.0	50.0	45	36.0	113.0
11	8.8	51.8	50	40.0	122.0
12	9.6	53.6	55	44.0	131.0
13	10.4	55.4	60	48.0	140.0
14	11.2	57.2	65	52.0	149.0
15	12.0	59.0	70	56.0	158.0
16	12.8	60.8	75	60.0	167.0
17	13.6	62.6	80	64.0	176.0
18	14.4	64.4	85	68.0	185.0
19	15.2	66.2	90	72.0	194.0
20	16.0	68.0	95	76.0	203.0
21	16.8	69.8	100	80.0	212.0
22	17.6	71.6	Boiling point of water.		

Readings on one scale can be changed into another by the following formulae, in which t° indicates degrees of temperature:

Réau. to Fahr.	Cent. to Fahr.	Fahr. to Cent.
9	9	5
$-t^{\circ} R + 32^{\circ} = t^{\circ} F$	$-t^{\circ} C + 32^{\circ} = t^{\circ} F$	$\left\{ t^{\circ} F - 32^{\circ} \right\} = t^{\circ} C$
4	5	9
Réau. to Cent.	Cent. to Réau.	Fahr. to Réau.
5	4	4
$-t^{\circ} R = t^{\circ} C$	$-t^{\circ} C = t^{\circ} R$	$\left\{ t^{\circ} F - 32^{\circ} \right\} = t^{\circ} R$
4	5	9

COMPARATIVE VALUE OF STOPS

The following table is published by Wilhelm Knapp of Halle, Germany, and while based on certain speed ratings, is applicable to any plate or film on a comparative basis. The photographer is urged to cultivate an instinct for light value and to develop a reflex ability to feel what the proper exposure should be under any conditions with a certain stop and to use this table to estimate the exposures for other apertures from that deduction. This table takes f:11, as the stop from which to start and figures toward left and right from centers, to f:4.5 as the largest, and to f:44 as smallest opening.

$f/4.5$	$f/5.5$	$f/6.8$	$f/8$	Proven value based on $f:11$	$f/16$	$f/22$	$f/32$	$f/44$
$\frac{1}{1000}$	$\frac{1}{480}$	$\frac{1}{300}$	$\frac{1}{240}$	$\frac{1}{120}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{16}$	$\frac{1}{8}$
$\frac{1}{600}$	$\frac{1}{400}$	$\frac{1}{250}$	$\frac{1}{200}$	$\frac{1}{100}$	$\frac{1}{50}$	$\frac{1}{24}$	$\frac{1}{12}$	$\frac{1}{6}$
$\frac{1}{500}$	$\frac{1}{320}$	$\frac{1}{200}$	$\frac{1}{160}$	$\frac{1}{80}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{5}$
$\frac{1}{360}$	$\frac{1}{240}$	$\frac{1}{150}$	$\frac{1}{120}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$
$\frac{1}{300}$	$\frac{1}{200}$	$\frac{1}{130}$	$\frac{1}{100}$	$\frac{1}{50}$	$\frac{1}{24}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$
$\frac{1}{240}$	$\frac{1}{160}$	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{2}{5}$
$\frac{1}{180}$	$\frac{1}{120}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$
$\frac{1}{140}$	$\frac{1}{96}$	$\frac{1}{60}$	$\frac{1}{48}$	$\frac{1}{24}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{2}{3}$
$\frac{1}{120}$	$\frac{1}{80}$	$\frac{1}{50}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{2}$	$\frac{4}{5}$
$\frac{1}{100}$	$\frac{1}{64}$	$\frac{1}{40}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1
$\frac{1}{70}$	$\frac{1}{48}$	$\frac{1}{30}$	$\frac{1}{24}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$
$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{25}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2
$\frac{1}{48}$	$\frac{1}{32}$	$\frac{1}{20}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{3}$	1	2
$\frac{1}{36}$	$\frac{1}{24}$	$\frac{1}{15}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$	$2\frac{2}{3}$
$\frac{1}{24}$	$\frac{1}{16}$	$\frac{1}{10}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4
$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$	$2\frac{2}{3}$	$5\frac{1}{3}$
$\frac{1}{16}$	$\frac{1}{10}$	$\frac{1}{7}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$	3	6
$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
$\frac{1}{10}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{3}{8}$	$1\frac{1}{4}$	$2\frac{1}{3}$	5	10
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{2}$	6	12
$\frac{3}{4}$	$1\frac{1}{4}$	2	$2\frac{1}{2}$	5	10	20	40	80
4	6	10	12	25	50	100	200	400
8	12	20	25	50	100	200	400	800

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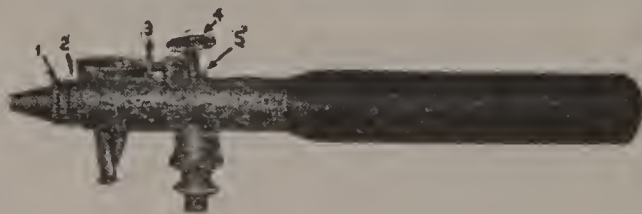
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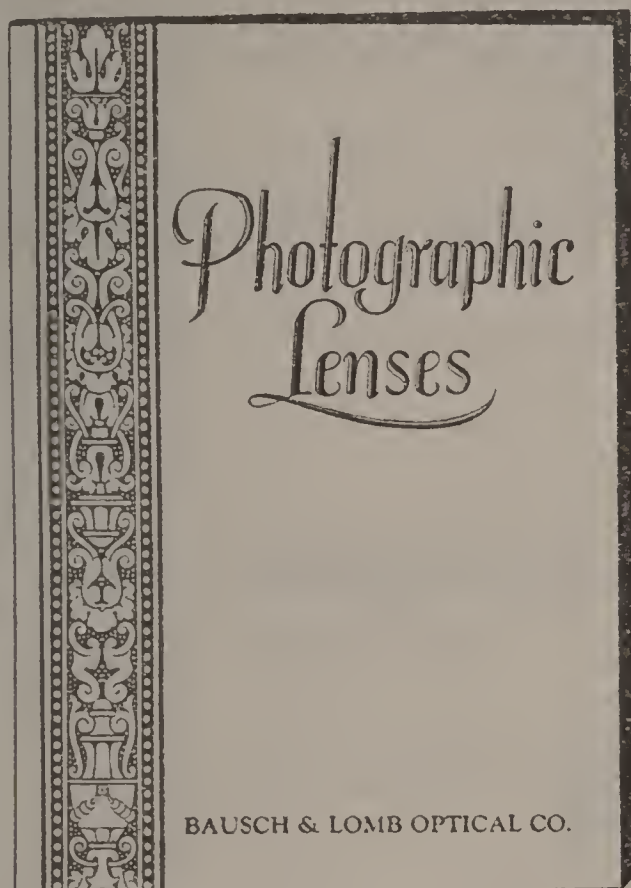
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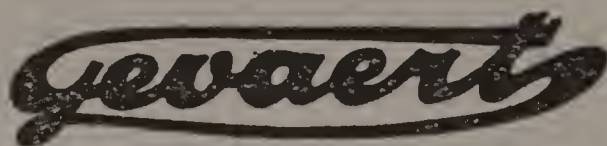
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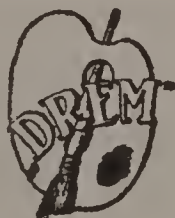
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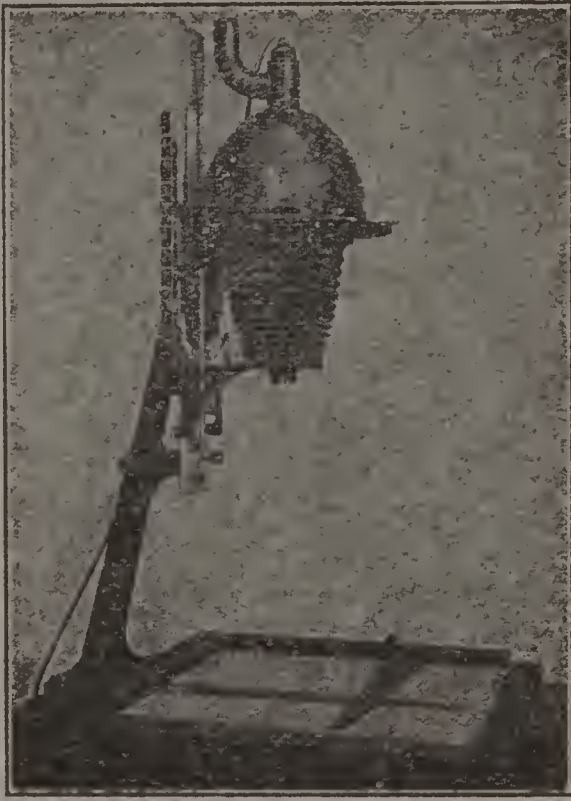
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